A Dissertation on

A VALUE BASED STUDY ON MAGNETIC RESONANCE IMAGING & ITS COMPARISON WITH MAMMOGRAM IN THE EVALUATION OF CARCINOMA BREAST

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CERTIFICATE

This is to certify that the dissertation entitled
A VALUE BASED STUDY ON MAGNETIC RESONANCE IMAGING & ITS COMPARISON WITH MAMMOGRAM IN THE EVALUATION OF CARCINOMA BREAST

is a genuine work done by Dr.B.AMIRTHA, for the partial fulfillment of the requirements for **M.S. Branch – I (General Surgery)** Examination of the Tamilnadu Dr.M.G.R. Medical University to be held in APRIL 2014. Under my supervision and the guidance of **PROF.VIJAYAN.MS ,** Department of General Surgery, Government Stanley Medical College and Hospital.

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DECLARATION

I, **Dr. B.AMIRTHA,** solemnly declare that dissertation **entitled A VALUE BASED STUDY ON MAGNETIC RESONANCE IMAGING & ITS COMPARISON WITH MAMMOGRAM IN THE EVALUATION OF CARCINOMA BREAST**

is a bonafide work done by me in the Department of General Surgery at Govt.Stanley Medical College & Hospital, Chennai, under the guidance of. **PROF.J.VIJAYAN.MS.,** Additional Professor of Surgery, unit Chief, Government Stanley Medical College and Hospital, Chennai-600 001.

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CONTENTS

ABSTRACT

AIM OF THE STUDY:

- To evaluate patients presenting with a breast lump and to evaluate them with clinical examination ,cytology and with MRI and interpret its findings- with regards to involvement of the opposite breast and axilla and level of infiltration and the sensitivity of the modality itself.
- To establish that MRI breast can be made as a routine investigating modality in the management of breast cancer by comparing it with mammogram
- To use MRI in detecting local site recurrences in patients with post MRM status presenting with pain /ulcers/nodules.
- In this sample size of patients ,the p value did not turn out significant(0.94143) and hence the comparison was not statistically significant .However, recent studies conducted in a larger population have shown that MRI has a better tumour predictability by terms of sensitivity when compared to a mammogram.hence MRI scanning of the breast can be included in both screening and diagnosis for breast

cancer in institutions where available , as it has various advantages over a mammogram like less radiation exposure ,use in younger age group, ability to add on level of infiltration and involvement of opposite breast and axilla.this one modality can guide the surgeon in deciding the treatment option in patients presenting afresh and post surgical patients

INTRODUCTION:

Dynamic MRI of the breast is viewed as an examination technique which is supplementary to mammography and sonogram and which can provide important additional diagnostic information. Accepted indications for MR mammogram include examination of patients who have undergone lumpectomy or mastectomy and patients having prosthetic breast implants. This method also appears to be useful for differentiation between postoperative scarring and carcinoma as well as to exclude a multicentric breast cancer prior to breast conserving surgery. The sensitivity of MR mammography, however is limited in cases of DCIS. After being diagnosed with breast cancer, a breast MRI may be performed to determine:

- Size of the tumor and level of infiltration
- The presence of multi centric lesions in the same breast & whether there is an undetected tumor in the opposite breast.
- Lymph node metastasis to the opposite axilla

REVIEW OF LITERATURE:

- KRIEGE ET AL studied 1909 women between twenty five and seventy years of age at 6 centers across Netherlands. After 3 rounds of screening 50 breast cancers were detected out of which 44 were invasive. 80% of these cancers were identified with MRI and thirty three% by a mammogram.43%percent of these tumours were less than 1 cm in size and 33% of them had spread to the axilla. However mammograms identified DCIS better than MRI and the specificity of both were 95% and 90 % respectively.

- Leach et al studied 649 women between 35-49 years of age at 22 centers in UK using various modalities.35 patients were diagnosed with cancer out of which 29 were invasive.45% of these cancers were less than a centimeter and 14% had spread to the axilla .the sensitivity in the study was 77%for MRI and 40 % for mammogram and specificity were 81% and 93% respectively

- Warner et al from Toronto screened236 women from 25-65 years of age for duration of 3 yrs & identified 22 new cases of which 16 were invasive using multi-modality. Sensitivity of MRI was 77% and 36% for mammogram and specificity were 95% and 99.8% respectively

- Kuhl et al at a center in Bonn studied 529 women starting from 30 and above for duration of 5 yrs. They identified 43 cancers out of which 34 were invasive with 1 interval cancer. Nodes were positive in 16 % of the study group. The sensitivity of MRI was 91% & mammogram was 33%.specificity of both were 97 %

- The International Breast MRI Consortium at 13 centers in the US studied 390 women between 25 yrs & above on a single occasion. They detected 5 cases of cancer out of which 4 were detected by MRI and only 1 by mammogram. However on further evaluation the specificity of mammogram was 98%compared to 95% with MRI.

- Sardanelli et al from Italy screened 278 women at 9 centres aged above 25 years .after screening 18 cases were detected with cancer out of which 14 were invasive.sensitivity of MRI was 94% compared with mammogram for 59%.MRI specificity was 99%

THEORY ASPECT:

Breast cancer is a malignancy arising from the terminal ductal lobular units of the breast and hence called ductal and lobular carcinomas respectively.

It is the most common malignancy in women, worldwide. There is a decrease in mortality due to early diagnosis,using screening mammograms and adjuvant treatment.Earlier detection is still important.

A small breast tumor usually carries no symptoms and treatable when detected early.

Hence , it becomes a must for women to follow the guidelines for screening as per recommendations to detect breast malignancy at its early stages. Common symptoms are: a lump in the breast without any pain or a lump in the axilla, breast pain, heaviness, skin changes, nipple discharge, and erosion.

The breast is made up of two types of tissues- glands & stroma. The former is made up of ducts & lobules. The latter is formed by the fat & fibrous tissue that form the skeleton of the breast by giving it its size

and shape.The breast contains fat, fibroglandular tissue and neurovascular tissue like arteries,veins, nerves and lymph nodes. The fibroglandular tissue is further divided as stromal tissue:fibrous connective tissue and Cooper's ligament(also called suspensory ligament) and glandular tissue :lobules and ducts. Breast cancer is considered as the abnormal growth of glandular tissue of the breast. Breast cancers that are confined to the epithelial cell layer that form the lining of the ducts and lobules are termed in situ, and generally considered curable by oncologists. Invasive carcinoma usually penetrates the basement membrane and invades surrounding stromal tissue. These tumor are capable ofmetastasis.1:8 is the average lifetime risk of a woman to procure cancer,& breast cancer is the 2nd leading cause of cancer mortality among women. The extent of spread decides on the survival .the 5 year survival for disease confined to the ductal –lobular unit is 98% and for regional disease that is still limited to the breast the survival is 84% and 23% for distant metastatic disease.hence , early detection of breast cancer is important for the management of breast cancer .

The human breast is described anatomically as overlying the 2nd - 6th rib, & extent: from lateral border of sternum upto the anterior line of axilla. Also , a thin layer of breast tissue extends from the clavicle upto to the 7th or 8th ribs & from midline to the latissimus dorsi posteriorly.This is important in a mastectomy, in which the whole breast has to be removed. The axillary tail of the spence has immense surgical importance. In some patients it can be palpable & it is considered normal, & in some it is seen premenstrually / lactation. A well formed axillary tail is often mis-diagnosed as an enlarged lymph nodes / lipoma.

A lobule is the structural unit of the breast. The number & size of the lobules vary among every woman: they are most in number in young women. From 10 to over 100 lobules empty into the ducts into a lactiferous duct which is 15 to 20 in number. Each duct is lined by spirally arrangedmyo-epithelial cells & a terminal ampulla — a reservoir for milk or abnormal discharges.

The Cooper's ligament are hollow cone like projections of fibrous tissue within the breast , the apex of the cones being attached to superficial fascia & hence to the skin over the breast. These ligaments when involved in a carcinoma cause dimpling.

The areola consists of involuntary muscles arranged in concentrically as rings & radially in the subcutaneous fat. The areola contains many sweat glands & sebaceous glands, the latter enlarge in pregnancy & lubricate the nipple while lactation & these are also called Montgomery's tubercles.

The nipple is overlayed by thick& corrugated skin . the apex contains the openings of the ducts. The nipple also made up of involuntary muscle fibres seen concentrically & longitudinally; thus is an erectile structure which points outwards. Lymphatic drainage of the breast is predominantly into the axillary & internal mammary lymph nodes. The axillary nodes receive 75 % of the drainage & are present as the groups below:

•lateral:parallel to the axillary vein;

•anterior: lateral thoracic vessels;

•posterior: subscapular vessels;

•central: embedded in the fat at centre of the axilla;

•interpectoral: nodes in between the pectoralis major & minor muscles;

•apical: lie above the level of pectoralis minor tendon ; continuos along the lateral nodes & receive the efferents from other groups.

The apical group of nodes are in continuity with nodes of the supraclavicular group & drain into the subclavian lymphatics which enters the veins directly or via the thoracic duct or jugular trunk. The sentinal node is that lymph node designated as the first axillary node draining the breast.

The internal mammary nodes are fewer in number and lie along the internal mammary vessels deep to the plane of the costal cartilages.

Magnetic Resonance Imaging (MRI) is a powerful & highly useful imaging modality that uses non-ionizing radiation by providing a very good soft tissue contrast.

The major composition of the body is water that is composed of 2 H atoms & 1 oxygen atom. Hydrogen atom is a proton& acts as an electric dipole, and in the presence of a large Field of magnetism , the protons will come to lie parallel/ antiparallel to the field. However,the net magnetization will be along the direction of the main field. In an MRI

scan, a short pulse tuned to the Larmor frequency excites a component of the magnetization into the transverse plane.

The tissue's relaxation properties and the proton density determine the received signal, and the imaging gradients allow spatial localization of the signal.

The quality factors in MRI are the signal-to-noise ratio (SNR), the presence of imaging artifacts and spatio temporal resolution.the clinical applications of MRI include cardiac,renal, vascular,breast, musculoskeletal, and brain imaging.High spatio-temporal resolution is crucial in dynamic contrast-enhanced(DCE) breast MRI in which morphologic and kinetic data are used to arrive at a diagnosis.

Types of breast cancer:

Breast cancer has several subtypes .Breast cancer can be divided into 2 types:

1. Carcinoma in situ :the malignant mass is confined inside the tissue in which it has developed

2. Invasive carcinoma: when the malignant mass invades surrounding tissue.

Histological subtypes:

1. Invasive ductal carcinoma (IDC). Begins in a duct, then breaks into the basement membrane & invades the stromal tissue.(75%)

2. Ductal carcinoma in situ (DCIS): Cancerous cells develop inside a duct, but do not invade the basement membrane.

3. Invasive lobular carcinoma (ILC): Starts in a lobule gland and invades into the surrounding tissue.(10%)

4. Lobular carcinoma in situ (LCIS): begins in a lobular gland, but does not penetrate the basement membrane of the gland's wall.

5. Medullary carcinoma: Invasive breast cancer which has a well-defined boundary between the cancerous tissue & surrounding tissue.(<10%)

Less common breast cancer types :

colloid carcinoma,

tubular carcinoma & adenoid cystic carcinoma.

Breast Cancer Subtype	Markers Expressed
Type Luminal A	ER &PR,ER/PR positive, low proliferation
Type Luminal B	ER & PR,ER/PR positive, high proliferation
HER2 /Neu Positive	HER2/Neu+ve
Thriple Negative	No markers expressed

Modes of spread in breast cancer:

1.Local spread: The tumour size increases &erodes other portions of the breast .i.e the skin /pectoral muscles/ chest wall.

2.Lymphatic spread: involvement axillary lymph nodes & internal mammary chain of lymph nodes. The site of the tumour within the breast does not dictate which nodes will be involved, e.g. medial tumours spread just as readily to the axillary nodes as do lateral tumours. The involvement of lymph nodes is rather a marker for metastasis. In advanced disease there may be involvement of supraclavicular nodes and of any contralateral lymph nodes.

3.hematogenous Spread :metastasis to bone as in the lumbar vertebrae, femur,ribs, thoracic vertebrae, & skull; they are osteolytic lesions. Liver, lung & brain, the adrenal glands and ovaries may also develop metastasis.

RISK FACTORS:

- The first and most important risk factor is being a woman ,the incidence ratio being 100:1
- The next being age
- Post pubertal weight gain , obesity,hormonal therapies ,alcohol consumption are all considered modifiable risk factors
- High breast tissue density,hyperplasia of breast confirmed by biopsy,high bone mineral density and chest irradiation increase the risk of breast cancer
- Nulliparity,age at first child birth being 30 or above ,long menstrual history and use of OCPS/HRT
- Family history of breast cancer and inheritance if BRCA1 /BRCA2 genes

Risk Factors for Breast Cancer in Women (American Cancer Society, 2012) Relative Risk Factor:

- **4.0:** Age:> 65 years of age upto 80 the risk increases steadily Biopsy-proven atypical ductal/lobular hyperplasia familial mutations for breast cancer i.e :*BRCA*1 & *BRCA*2 increased breast density on mammogram Personal h/o cancer breast
- **2.1 - 4.0:** High levels of endogenous estrogen /testosterone High bone density in elderly post menopausal age group Irradiation to chest wall in high doses 2 1st-degree relatives having a h/o cancer breast
- **- 2.0 :**Alcoholism

  Ashkenazi Jew lineage

  Menarche as early as 12 years of age

  Tall stature

  Greater socioeconomic status

  First full-term pregnancy at >30 years

  Late menopause at >55 years

H/o not breast feeding child

Nulliparity or no full-term pregnancies

Obesity

One 1st-degree relative with breast cancer

Personal h/o endometrial, ovarian, or colonic malignancy

Recent use of hormonereplacement therapy postmenopausally estrogen & progestin)

Recent use of OCPs

CLINICAL PRESENTATION:

- Painless lump, palpated through self-examination or clinical breast examination.
- An abnormal finding on a mammogram or MRI can identify cancer even before the lump becomes palpable.
- nipple abnormalities, skin irritation/ redness/thickening, bloody nipple discharge in non lactating Women and swelling.

- palpable axillary nodal metastases or even metastases to the bone, brain or liver, may be the only presenting sign
- Clinical presentation
- Upper outer quadrant is the commonest site of breast cancer although it may occur anywhere along the breast tissue. They commonly present as a hard lump, along with indrawing of the nipple. As the disease progresses there will be involvement of the skin in the form of peau d'orange / frank ulceration & chest wall fixity. This is also known as cancer-en-cuirasse. The locally advanced breast cancers present as 5 per cent of breast cancers in the developed world and upto 20 per cent in the developing world. The patients must be evaluated for staging so that the nature &extant of the disease can be ascertained. This will include a careful clinical examination, chest X-ray, serum alkaline phosphatase and gamma glutamine transaminase (GGT), with liver ultrasound if these are abnormal, and an isotope bone scan . This is important for both prognosis and treatment — a patient with widespread visceral metastases may obtain an increased length and quality of survival from systemic hormone or chemotherapy, but

she is not likely to benefit from surgery as she will die from her metastases before local disease becomes a problem. In contrast, patients with relatively small (less than 5 cm in diameter) tumours confined to the breast and ipsilateral lymph nodes rarely need staging beyond a good clinical examination as the pick-up rate for distant metastases is so low.

- Phenomena resulting from lymphatic obstruction in Staging of breast cancer
- advanced breast cancer
- Peau d'orange: is due to oedema of the skin. When the skin infiltration is tethered due to the sweat glands & their ducts which cannot swell, causing an appearance like orange peel. The same finding can also be seen in a chronic abscess.
- Late oedema of arm is a troublesome complication of breast cancer treatment fortunately seen less often now that radical axillary dissection and radiotherapy are rarely combined. It does however occasionally still occur after either modality of treatment alone and appears anytime from months to years after treatment. There is usually no precipitating cause but recurrent tumour should be

excluded as neoplastic infiltration of the axilla can cause arm swelling due to both lymphatic and venous blockage. This neoplastic infiltration is often painful due to nerve involvement.

- An oedematous limb is susceptible to bacterial infections following quite minor trauma, and these require vigorous antibiotic treatment. Treatment of late oedema is difficult but limb elevation, elastic arm stockings and pneumatic compression devices can be useful.
- Cancer-en-cuirasse:The chest wall is infiltrated with malignancy and looks similar to a coat.
- It is often associated with a grossly swollen arm,and this is seen in local recurrence following mastectomy, and occasionally is seen to follow the distribution of irradiation to the chest wall. The condition may respond to palliative chemotherapy however survival is poor.
- Lymphangiosarcoma is rare complication of lymphoedema with an onset many years following the original treatment. It takes the form of multiple subcutaneous nodules in the upper limb and must be distinguished from recurrent carcinoma of the breast. The prognosis is poor but some cases respond to cytotoxic therapy or

irradiation. Interscapulothoracic (forequarter) amputation is sometimes indicated.

AJCC Cancer Staging. 7th Edition (AJCC, 2011)

Tumor size:

TX : tumor not assesses

T0 : No primary tumor

Tis:

Tis DCIS

Tis LCIS

Tis Paget disease of the nipple with no tumor.

T1 :Tumor <_ 2cm size

T1mic: Microinvasion < 0.1cm

T1a :Tumor >0.1 cm but < 0.5 cm

T1b: Tumor > 0.5 cm < 1.0 cm

T1c :Tumor > 1.0 cm < 2.0 cm

T2 :Tumor >2.0 cm but < 5.0 cm

T3 :Tumor > 5.0 cm

T4 :

T4a : chest wall involved, does nt include pectoral muscle

T4b: Edema / ulcer of skin / satellite nodules in the same breast

T4c : T4a and T4b

T4d: Inflammatory breast carcinoma

Regional lymph nodes (N)

NX : nodes not assessed

N0 :No regional lymph node deposits

N1 : mobile same side axillary lymph node(s) involved

N2

N2a :Metastasis to same side axillary lymph nodes which are matted

N2b: involvement of clinically palpable ipsilateral internal mammary nodes & no axillary lymph node metastasis

N3 :

N3a :same side infraclavicular lymph node involved

N3b: same side internal mammary lymph node & axillary lymph node involved

N3c :same side supraclavicular lymph node involved

Pathologic classification (pN)

pNX: local lymph nodes not assessed

pN0 :-ve local lymph node metastasis by histology

pN0(i-): -ve local lymph node metastasis by histology, negative immunochemistry

pN0(i+:) –ve local lymph node metastasis by histology, +ve IHC, & no IHC clustering >0.2 mm

pN0(mol-) :-ve local lymph node metastasis by histology, & _ve molecularity

Stage 0 (DCIS): Nearly 100% 10-year overall disease-specific survival rate.

Stage I: 90% 10-year overall disease-specific survival rate.

Stage II: 75% 10-year overall disease-specific survival rate.

Stage III: 40% 10-year overall disease-specific survival rate.

US PREVENTIVE TASK FORCE: recommends genetic testing for BRCA mutations (American Cancer Society, 2012) for:

1. Women who are not of Ashkenazi (Eastern European) Jewish heritage should undergo

genetic evaluation if they have any of the following riskfactors:

• Two first-degree relatives either mother/ sister/ daughter, one of whom was diagnosed when

less than 50.

• Three or more first- or second-degree relatives (including grandmother& aunt) diagnosed

with breast cancer.

• Both breast & ovarian cancer in 1st/2nd degree relatives.

• A 1st degree relative with cancer in both breasts.

• 2 or more 1st /2 nd-degree relatives with ovarian cancer

• A male relative with h/o breast cancer

2. Ashkenazi women of Eastern Europe must undergo molecular& genetic

studying, if they have:

• 1st degree relative with history of breast / ovarian cancer.

•atleast 2 2nd degree relatives in the family with breast / ovarian cancer.

The ACS guidelines for the early detection of breast cancer: in women with average risk & no symptoms:American Cancer Society, 2012:

Age 20-39:

• (CBE) at least once in every 3 years.CBE:clinical breast examination

• BSE:breast self examination

Age 40 and over:

• mammogram annually

• clinical breast examination annually - prior to a mammogram

• BSE:breast self examination

BSE:Breast self-examination must begin as early as 20 years & performed every month. The breast is easily examined immediately following menstruation. This can be uncomfortable to patients, especially inthr presence of fibrocystic change because it will be inconclusive. BSE must be

learnt early & reinforced regularly. If a palpable tumor develops, women who perform BSE present with smaller tumors (1 cm or less) than the women who do not perform this technique. Improvement in survival from breast cancer has not been demonstrated, however.

Some women should not practice BSE because of the psychological trauma they suffer

from frequent false-positives. These women need a breast examination by the physician once or twice in a year.

CBE: Clinical breast examination also should begin as early as 20 years & done every year for women with moderate risk for breast cancer. Tumors <1 cm are difficult to detect excepting experienced clinicians whereas tumors >1cm are detected easily. As the tumor grows, 96% of tumors larger

than 2.0 cm can be identified on physician physical examination. Clinical breast examination

must be included in the primary care health system maintenance & screening programs.

Screening modalities:

Mammography,CBE: physical examination by at least 2 Early Breast Cancer staff & breast self-examination (BSE) are important mass screening tools

Mammography is proven to reduce the mortality due to breast cancer. A medio-lateral oblique-view mammogram alone showed a reduction in mortality by 32% in women aged 40–74years. The overall sensitivity is 91–100% for women aged above 50 & 83% for40–49 year old women. Denser breast tissue in young women are a cause of decreased sensitivity & the sensitivity can further be increased by a two-view mammogram. Single view mammogram was preferred due to minimal radiation dose. With latest mammographies the risk is quiet low. A research conducted on 1- versus 2-view mammograms have concluded that a second additional (craniocaudal) view, the sensitivity increased from 83% to 89% & 14 new cases were detected out of 217 patients.Recall to the hospital was reduced by the second view, (8.8% to 6.6%).hence , by the addition of two views is proven to be more accepted& effective & is very sensitive as a first screening modality. The effect of using clinical examination only is not yet tested.it is usually done in combination with a

mammogram. An analysis done in Edinburgh shows that the 63% sensitivity for mammograms & 40% for clinical examination . There is no proven advantage of breast self-examination, as there is no proven evidence of reduction in mortality by this method. The sensitivity appears to be low as it is an entirely subjective method. However they can be done frequently when compared to a professional clinical breast examination .there is also a reduction in the size of the tumor by self-breast examination as the patient presents earlier to the medical set up. Women should be encouraged to practise, as it allows an earlier diagnosis.Mammography has a false-negative rate of at least 15%. For a breast cancer to bedetected on mammography, it must have tissue characteristics that are different from the surrounding tissue. Some tumors, particularly lobular carcinoma, invade the surrounding breast

tissue in a way that does not alter the characteristics of the breast tissue. Such tumors are often not visible on mammogram

MRI is a newer modality that is proven to have higher sensitivity for the purpose of detection of abnormality in the breast. women above the age of 50 are the population at greatest risk of cancer breast.Mammography is a relatively cheap,& effective & quick mode of screening of the breast.MRI is not been used as a mass screening tool. It is very expensive,& the equipments & experienced clinicians are unavailable at all places these days, &the procedure is takes some time. But MRI is used in screening young women (<50 years) who are at a high risk of developing breast cancer. In these groups, the breast will be dense on mammogram & they are difficult to conclude. The need to screen women at high risk of breast cancer is well recognized,as they can get affected at a younger age than the rest of the population and there are always issues of repeated radiation exposure. With the invention of newer methods of genetic studies, high risk groups can be identified, in which X-ray mammograms is nt a good method of screening. MRI tends to avoids radiation exposure,along with higher sensitivity in to detect breast cancer, also in the dense breast. Annual MRI on comparison with annual mammogram in the risk group has shown a higher sensitivity. MRI is currently recommended for screening in group of women (25–29) &

those aged 30–50 in those with denser breasts. No screening is currently adviced for women less than; women of 30–50 years with denser breasts must have annual 2-view mammogram, those over 50 years of age will have 3-yearly mammogram.

Triple assessment:

Patients with breast lump / symptoms suggestive of carcinoma, the diagnosis must be made by clinical assessment, tissue sample taken for either cytological or histological analysis & radiological imaging are done and this is called triple assessment.

NEWER IMAGING TECHNIQUES:

A film screen mammogram is considered as the well established technique for imaging of the breast: screening & diagnostic.this method detects about 85% of breast cancers & diagnose these at an earlier stage to decrease the mortality by upto 50%. Mammogram is the most common imaging technique used all over the world.In a mammogram a beam of X-rays traverse the breast & project a image on a film.Newer imaging modalities are the requirement of the present

Radiologists have a varied ability to read mammograms Mammograms have a specificity which is low. The chance that a lesion detected by mammogram & Biopsied ,the chance it will turn out to be malignant in about 20 to 35%.Densities of tissues are all similar & this causes decreased sensitivity. X- radiations can cause DNA damage

A) MRI Imaging

- *Cancer diagnosis :*

MRI uses magnetic fields as well as radio waves for diagnosis . Patients must lie down on a table during the procedure, taking about 30 minutes duration. They are moved into the MRI machine, which has a strong field of magnetism. An IV contrast material is injected into the patient's veins & the magnetic resonance monitors the way in which the contrast is taken up by the tissue & its clearance. In order to identify a mass it must have a different appearance from normal tissue. In that case of MRI, the contrast between the tissues is 10 to 100 times more than that produced by x-rays . MRI can detect malignancies not detected by mammogram. The huge disadvantage of MRI of the breast is the cost, 5 times more costlier than a X-ray mammogram.

- *MRI guided biopsy:*

  The MR systems consists of a low-field (0.5T) superconducting magnet with its configuration in open mode & this allows the clinician some access to the interventional field. This machine was built for guiding biopsies: imaging will be done during the procedure, and the physician selects an image at the beginning,during and after the procedure.These machines are still experimental,& costly, & few are in use.All over the world.

B) Digital Imaging

The detector will absorb the x-rays & modify them into an electrical signal &creates the digital image. When images are created there is no actual need for a film & the cost and time are saved.

a) Stereotactic imaging

Stereotactic breast biopsy: currently commercially available digital mammograms. They contain detectors which are very small, & the radiologists have the opportunity to identify a lesion discovered by a mammogram,& accurately put a needle into the center, & to extract tissue

samples. The patient can opt for a least costly, least invasive, & more cosmetic procedure when compared a conventional biopsy.

b) Full field digital mammography:

it is in the research stages. Digital mammogram is “an evolving technology with the greatest potential on management of breast cancer”. It provides an image with features of high-resolution& high-contrast with the least radiation exposure to the patient.

c) Single Energy X-ray technique

it is also called defraction-enhanced imaging (DEI). It produces a much clearer,& picture with enhanced details of the breast , & this can improve the efficacy of mammogram. This procedure utilizes a single-energy X-ray source. This technique is also under research, and still more researches are needed to be done before it can be used in the community.

d) 3D digital reconstruction

This follows the principles of needle biopsies to detect breast cancer. Guided biopsies are done using stereotactic biopsy needles& digital detectors . The image is very satisfactory, & can generate both 3D /2D

images of the breast. This will improve the accuracy of diagnoses using a mammogram.

e) Tomosynthesis:

multiple images are obtained using the x-ray tube which is moved as an arc over the static breast & digital detector. This method carries the same radiation dose toimage the whole breast as that of a single film-mammogram. Any plane of breast can be brought into a sharp focus.it can increase the specificity of mammogram as it reduces the fibroglandular tissue that mask the lesion.it is extremely useful in women with dense breasts.

f) Computer-aided diagnosis

in this method the mammogram and the computer systems are linked. The computer automatically draws an area of abnormality, marking the suspicious regions. Older methods of pattern recognition & detection of microcalcifications in digital mammography.

C) Ultrasound Imaging

a) High frequency Sonography

Sonograms demonstrate the borders & internal texture, precisely when compared to a

mammogram. They easily identify simple cysts of the breast. They alter the degree of suspicion of malignant lesions,& delineate the extent of lump in the breast .

b) Doppler study:

malignancies of the breast show increased blood flow, which is important for metabolism.this method allows to detect normal / abnormal vascularity in the mammary gland. This is quiet easy &non invasive.it can also assess the blood velocity & volume.

c) Contrast Imaging

Ultrasound contrast imaging : in this method a “contrast ”in a microbubbled gas form is injected IV. They cause echo-enhancement& so in malignancy the signals received are long &great when compared to

benign lesions. Malignancies also show changes in morphology of blood supply, with neovascularity seen on the lesion. Contrasts improve vascular markings. The signal-to-noise ratio is increased , & accuracy of diagnosis is alsoincreased.

d) Sonoelasticity:

this type of ultrasonogram visualizes the elasticity / stiffness of structures

as demonstrated by the movement of the tissue to a vibration source.so the hard tumors which are usually missed by older ultrasonograms can be detected using a sonoelastic technique.

e) Guided biopsy

this technique utilizes real-time imaging like a movie & this system produces a definitive diagnosis .This can be done in combination with mammograms.

D) Nuclear Imaging

a) PET scans:

in PET scans ,the patient is injected a radiolabelled glucose tracer. Cells

have increased metabolism, like in case of infection /cancer, will pick up more of glucose. The radioactivity of the radiolabeled glucose is studied by a PET camera,& the image analysed & regenerated by a system i.e areas of hypermetabolism will be bright on the image created& similar to a routine CT scan. It is costly & the trcer is not available everywhere PET scanning is not commonly performed.it is possible to predict the response to systemic therapy in neoadjuvant therapy using PETscan, but methods take several months to show results. These scans can also detect metastasis to other sites before surgery.

b) Sestamibi scans:

Commonly applied radiolabelled tracer in scanning of the breast is Tc-99m-sestamibi. It is aradioactive isotope, tagged with biological molecules, & are injected IV into patients.They reach the area of interest & then,a gamma camera is used which converts the emissions into images

which detail both the function as well as anatomy of the structure. Sestamibi scanning of the breast has only been proven to be effective in large breast cancers, & its role in the diagnosis remains unestablished.

E) BioElectric Imaging:

This method can detect the tumors at an early stage and pre malignant

lesions without radiation to the patient. Alterations in the water content & properties of the cell membrane of the cell cause changes in the electrical impedance of the tissue. The principles of the procedure is similar to an USG . This technique is useful in young women (below 50 years of age) as they have increased breast tissue density & that will not be effectively studied with a traditional mammography.

F) Optical Diffusion Imaging:

this imaging method uses infrared rays due to its ability to probe tissue oxygenation &metabolism .this method is non invasive & cost effective & uses non-ionizing radiation. structures allowing light penetration of the laser are those which have a low absorbing window. The conclusion is

made with the degree of tissue attenuation at both the wavelengths &this can diagnose malignancy.

American cancer society guidelines suggest including MRI along with mammographic screening in women found to be high risk for breast cancer. These include:

- Known cases of BRCA1 AND BRCA 2 mutation
- Women whose mother/sister/daughter are known carriers of BRCA mutations
- Risk assessment tools that find 20-25% or more chance of breast cancer in one's lifetime for any woman
- Patients with history of chest wall irradiation between 10-30 years of age, for eg: being treated for hodgkin's disease
- Women with genetic disorders such as Li-fraumeni /cowden syndrome or any first degree relative with the disorder

However, MRI of the breast has certain common uses such as:

- For further evaluation of the lesions detected by a mammogram
- In case of women with high risk and dense breast tissue in whom a routine mammogram need not give adequate information

- Women with inaccurate results with mammogram
- Patients with no clinically palpable lump in women who also have a highly suspicious lymph node in the axilla
- Useful in assessing the size and location of multifocal breast malignancy
- In patients whom treatment options may be decided with help of an MRI as to whether to do mastectomy or a conservative lumpectomy
- Breast MRI is known to detect malignancy in the opposite breast as women presenting as malignancy in one side usually have a risk of 10% of procuring cancer in the opposite one
- Involvement of the chest wall in patients with breast cancer
- To detect tumor recurrence following a mastectomy or lumpectomy
- In patients with newly detected inversion of nipple which requires evaluation

ADVANTAGES OF MRI BREAST:

- It is a non-invasive imaging modality with does not have any risk of exposure to ionizing radiation
- It is more valuable in breast cancer ,than a mammography /ultrasound as it can both detect and stage a malignancy on which the other two fail to provide information
- Contrasts used in MRI studies are less allergic
- It has growing popularity in detecting early breast cancer
- Detects small breast lesion that are missed by mammogram
- Traditional mammograms donot detect lesions in dense breast tissue and in breast implants, and MRI is useful in both these situations
- Used as an additional tool along with mammogram in evaluating women with high risk of breast cancer
- In a lesion detected only by MRI ,a guided biopsy can be done using MRI.
- MRI is better in detecting response to chemotherapy than other modalities
- MRI changes the treatment plans in about 15-30% of cases

LIMITATIONS:

- The patient has to lie still for high quality images
- Obese patients may not fit into the machine
- Implants and metallic objects hamper the quality of image
- First trimester of pregnancy-it is usually not advised to undergo MR imaging
- Presence of edema usually affects the result of the study, as MRI cannot distinguish malignancy and edematous tissue
- Obviously, MRI costs more than any other modality
- Contrast enhanced MR images may pick up benign pathologies ,which has to be finally decide by the radiologist
- It has limited availability ,only available in higher centres
- Tiny calcifications of ductal carcinoma in situ cannot be detected in MRI

BREAST IMAGING TECHNIQUES:

The American Cancer Society (ACS) guidelines recommend:

- Annual x-ray screening mammography for women from age of 40 and do regular follow up until she is in good health.
- MRI: first line screening modality for women with a lifetime risk as high as 20-25% or greater for breast cancer. Recent studies have shown MRI to be more sensitive for this population as compared to mammography.
- Mammography: Low-dose x-ray procedure is the standard screening imaging modality for the breast. Tissue contrast in mammography is usually the tissue's absorption of the x-ray as it passes through the breast. Cancers on mammography are visualized as mass or micro calcification. The sensitivity of mammography remains variable.

MAMMOGRAM:

A x-ray modality used to image the breast

1. screening mammogram:when performed in a woman with no symptoms
2. diagnostic mammogram:. When performed in women with symptoms, like a mass/ after an abnormal screening, this includes additional magnifying images and often will also include a focused ultrasound.

The sole idea of a mammogram for screening is detection of breast malignancy. Screening is done in situations of no signs / symptoms, for detecting the cancer as soon as possible. A routine mammogram increase the chance of a woman being diagnosed with breast cancer at an early stage, when it is curable. It is proven that this method can detect cancer in 2-3 years earlier than it becomes palpable. The American Cancer Society (ACS) recommends a yearly screening study for all woman above 40 years and at moderate risk. Presence of microcalcifications/ other abnormalities are commonly associated with cancer. New digital system & computer-aided detection(CAD) aid in the mammograms detection of tiny calcifications.

The greatest risk factor for breast cancer is age. Certain women with a family history ofcancer are at a higher risk. Mammography must begin at a younger age for them.

Diagnostic : to study in detail the existing tumori.e.a lump/nipple discharge/ focal tenderness .Detailed evaluation of abnormalities detected on screening can be studied furhther. The radiologists view them&additional views are taken if necessary.An ultrasound is used to determine cystic or solid areas ina lesion.PET scans / MRImay be done for detailed study of a tumor, but mammograms are very useful fordetection of small tumors while screening.

Procedure:

A mammogram may be performed in various centres.. Mammography is done with machines having x ray beam filters.smaller dtails of the breast are visualized using latest equipments

A woman must fill a questionnaire regarding her medical history, personal & family history of cancer, menstruation pattern , previous breast surgeries, children use of OCPs, & HRT.

A physical examination must be prior to a mammogram & records of lump/ nipple discharge,mastalgia are made.Scars must be made a note of.

Patient must remove her clothing and jewellery and wear hospital gown. A metal marker is inserted into the nipple. Thus the nipple will act as a reference helping in precise tumor identity and location.

- Craniocaudal position (CC):the patient is asked to face the machine either standing or sitting. One breast is placed at the cassette holder by raising is adjusted to level.the mid film will now contain the whole breast along with the nipple &head turned to opposite side when the film is taken. The chest wall must be relaxed & backwards while the breast is pulled forward. The technician will hold everything in place &increase the compression between the film holder & paddle using a foot pedal adequate breast compression means that the skin is tight & the lateral sides firm. The picture is taken .this procedure may make the patient uncomfortable however being important. Compressed breasts have reduced thickness ,creating a uniform density & separating the overlying tissues. This provides a good image &low radiation exposure. This is again done on the opposite breast.

- Mediolateral oblique position (MLO):the patient must lie on her side facing the machine. The film holder must be along the pectorals muscle,& this varies by the stature of the patient.The machine lies in level with the axilla. The arms are placed on the cassette holder. The breast tissue is lifted forward & above & a good compression is applied. The nipple must lie at its level & the other breast is held away. This is done again for the other breast. Four x rays, two for a breast, are pictured. A diagnostic mammogram may require some more x rays in different positions

A mammogram is studied by a radiologist . in case of areas of suspicion of an abmormality extra films must be taken. A screening mammogram takes 15 to 30 minutes& a diagnostic mammogram amy take an hour.

Mammograms are not costly. A woman can take a mammogram out of her own self and does not require a physician’s prescription.

Pre procedure steps:

A mammogram requires compression and that can be painful. Mammograms must be done when the breasts are less tender. One / two weeks following a menstrual period , as the breasts are tender during menstruation. It also helps by reducing the caffeine intake prior to the procedure. Women with hormone therapy have mastalgia.Analgesics may be prescribed in patients who are anxious .Women must not use any perfumes or powder while mammogram. Particles may stick to the film &may produce abnormalities.

- **Calcifications**: Calcifications are small mineral deposits within the breast tissue.they are commonly found in cancer

. There are 2 types of calcifications:

1. Macrocalcifications:

   Coarse calcium deposits arteriosclerosis of vessels, trauma& inflammation. They are usually not malignancy and doesnot warrant a biopsy. They are common in older women.

2. Microcalcifications:

   Tiny particles of calcium in the breast, either solitary /clustered. The shape & layout of microcalcifications provide adequate details of the lesion &helps to analyze how likely it is that cancer is present. In case ofa suspicious lesion , a biopsy will be needed.

Masses:

Masses, with /without calcifications, may also be seen on mammograms. Masses can be cysts –benign /malignant & solid tumors –benign such as fibroadenomas,or malignant. Architectural distortion of the breast, skin / nipple which require further evaluation.

Breast Density:

An additional measure seen on a mammogram is the breast density, which is defined as the proportion of fat to connective tissue in a women's breasts.fat is considered non dense and connective tissue is considered dense. There are four categories for breast density :

1. Entirely fat : i.e there is less than 25% stroma

2. Scattered fibro-glandular dense tissue: 25 - 50% stroma present in breast tissue

3. Heterogeneous density: 51 - 75% stroma in breast tissue

4. Extreme density: > 75% stroma in the breast

Breast Imaging Reporting and Database System by The American College of Radiology

Category Assessment Follow-up Recommendations

0

Require more evaluation, Prior Mammograms must be compared or newer images needed

1

Negative- will only require regular screening mammogram every year for women more than 40 years of age

2

Benign –regular screening mammography every year for women above 40 years

3

Probably Benign – follow up in a short time & then evaluation every 6 months

4

Suspicious Abnormality – Biopsy must Be Considered

4A: low suspicion

4B: moderate suspicion

4C: Findings not classic for malignancy

Will need biopsy

5

High suscpicion for malignancy needing a biopsy

6

Biopsy-Proven Malignancy

BREAST MRI:

The female breast consists of fatty and glandular tissue, which in turn contains the lobules for purpose milk production and connected to the nipple by the ducts.Malignancy can be missed due to dense breast tissue or incorrect positioning of the breast or simply due to a failure to detect the abnormality.

Dense breast tissues can attenuate x-rays at a comparable rate to cancer, making the diagnosis more difficult. Hence mammography is of less use and this is most evident in women at younger age &higher risk for malignancy, as denser breasts and aggressiveness of the cancer contribute to the sub optimal mammogram sensitivity in this group.The latest digital mammography systems have shown to screen in dense breast tissue , but there is still room for improvement.

MRI uses magnetic fields for viewing the breast. The primary and foremost advantage of a MRI over mammogram is that it features

excellent soft tissue contrast that is used in assessing the morphology and exact location of lesions. Clinical breast MRI is done by the administration of an intravenous contrast that helps to visualize the tumor and differentiate between benign and malignant lesions based on shortened T1.breast MRI are not included in routine breast evaluation due to its high costs and their variable specificity.this low specificity is considered due to lack of standardization as well as lack of expertise in this field. Breast MRI is also prone to a wide range of imaging artifacts like the cardiac motion artifact/ susceptibility-induced artifacts/failure of fat suppression that could potentially reduce quality of the image. Breast MRI is a rapidly evolving field with growth of experienced practitioners and newer innovations in both the hardware and the software. The false-positive rate of MRI is usually around 5%.

Role of MRI in Breast Cancer:

Breast MRI offers information about many breast conditions that is difficult to be obtained by mammography or ultrasound, especially in higher risk patients,EG: genetic susceptibility. Breast MRI is also frequently performed during the diagnosis of all early breast cancers in

order to identify contralateral and additional ipsilateral breast involvement.

Case reports have shown that MRI staging in breast cancer patients leads to occult malignant findings in the ipsilateral breast in upto 3.5% and the contralateral breast upto 2.9%. The routine preoperative breast MRI evaluation following a diagnosis of breast cancer is currently considered controversial because the ultimate impact on patient outcome has not yet been defined. However , MRI is a very sensitive method of breast imaging, with many studies proving that MRI can improve the preoperative staging of breast cancer & has now become a popular tool to help in surgical planning and for the detection of occult cancers .

1.8 Limitations of MRI

•Normal glandular tissue in the proliferative phase of menstrual cycle may show certain enhancement.

• Benign disorders & post irradiation& surgical scars make it difficult to differentiate local recurrence & granulation.

• it is difficult to differentiate between inflammatory carcinoma and mastitis.

OTHER IMAGING MODALITIES:

BREAST ULTRASOUND:

Ultrasound usually transmits high-frequency sound waves to a tissue and records the received echoes and transforms them into a video image. Ultrasound remains a second-line modality used for differentiating palpable lesions, with regards to breast evaluation. Especially ultrasound can differentiate a cyst and a solid mass. Especially in women below 30 years of age, ultrasound is recommended before a mammogram or MRI for assessing whether a lesion is a mass or a cyst. It can also be used for spatial localization of a clinically palpable tumor while the course of a biopsy or aspiration procedure. The disadvantage with the conventional ultrasound is that it is highly observer-dependent resulting in inaccurate diagnoses in in experienced hands.

BREAST MRI: TYPES:

PULSE SEQUENCES: The American college of radiology usually follows a clinical protocol which includes the presence of a T2weighted scan and a T1 weighted double contrast enhanced-MRI with 1 pre-contrast and 2 post contrast images produced using a bilateral breast coil

An initial T2 weighted scan should be performed before the contrast injection primarily to confirm a benign tumor.both the 2D Fast Spin Echo (FSE) sequence and the 3D –FSE-Cube (carries advantage of improved spatio temporal resolution)are used]this makes the scan time more feasible. Alternative breast MRI imaging techniques like diffusion image and Perfusion MRI are used to find the differential diagnosis of lesions.

TEMPORAL VS SPATIAL RESOLUTION:

Both the spatial and temporal resolution techniques and making a correct choice of these parameters has a strong impact on the diagnostic accuracy. There are conflicting reports on the benefits of high spatiotemporal resolution on DCE-MRI; two groups show diagnostic benefit of increasing spatial resolution but no significant loss in diagnostic accuracy with decreased temporal resolution. Certain, other

studies claim that a good combination of high temporal and high spatial resolution may lead to improved diagnostic accuracy.

There is no standard protocol for breast MRI and the choice of imaging parameters is highly dependent on the institution and the radiologist. It is recommended to perform bilateral imaging as the contralateral breast is useful for comparison, and also used to detect pathology may also be found in the contralateral breast. Imaging of both the breast is usually performed in the axial plane due to the ability to cover both breasts in a reasonable number of slices when compared to sagittal imaging and good visualization of the nipple when compared to coronal imaging. Fat must be removed from the image for a clear visualization of the lesions, but

there are conflicts whether to actively suppress the fat or to exclude it by using subtraction. Fat suppression is significantly much better than subtraction .

The number of phases for DCE-MRI should be adequate to detect the initial enhancement and also the subsequent later enhancement, and it is important to use a routine or regular receiver settings for all phases. Further, alternative and newer breast MRI techniques such as Diffusion

Weighted Imaging and Perfusion MRI can aid in the differential diagnosis of lesions.

People in support of subtraction argue that it requires no additional scanning time, and its performance is also relatively immune to the field in homogeneities however certain group of clinicians are in favour of suppression as fat acts as an anatomical reference.

HARDWARE USED IN BREAST MRI:

It is recommended to use a good, bilateral breast coil,and recent advances facilitate parallel imaging. Bilateral imaging of the breast enables comparison with the opposite breast which will be useful at diagnosis.continous imaging of both breasts with better use of the IV contrast agent and it helps avoid diagnostic errors in patients with non-masslike enhancement or enhancing foci detected in non contrast films.Breast imaging at 3T has the benefit of higher SNR, but at the expense of B0 andB+.The image in one breast appears to have higher intensity than the other breast, and these are considered in homogeneities. The T1-weighted image can vary from side to side, and so the conspicuity of lesions on T1-weighted images usually varies. Depending on the fat

suppression used, these in homogeneities may result in fat suppression failures in some regions.

CRITERIA FOR DIFFERENTIAL DIAGNOSIS:

Differential diagnosis of breast lesions on MRI are done based on

- assessment of the morphology of the lesion- including the size,enhancement type ,shape and margins of the mass,distribution of the enhancement and internal architecture.
- Enhancement kinetics & the lesion intensity on T1W and T2W scans.
- High spatial resolution imaging has the ability to detect kinetic information ,initial enhancement ,presence or lack of peak enhancement and the delayed enhancement patterns.

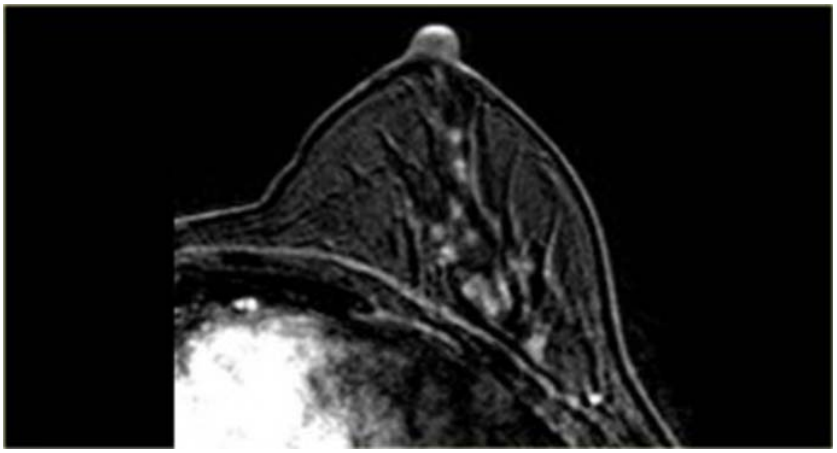
The radiologist will assess the enhancement kinetics qualitatively by reading through sections and time points, this hugely depends on the experience on the radiologist. There are certain quantitative methods of assessing the enhancement kinetics such as measuring mean signal of ROI or using computer aided detection, much better than results obtained

by radiologists.the pre –contrast T1wighted image establishes a baseline,T2weighted image is used to confirm the benign diagnosis.

BI-RADS OF MRI:

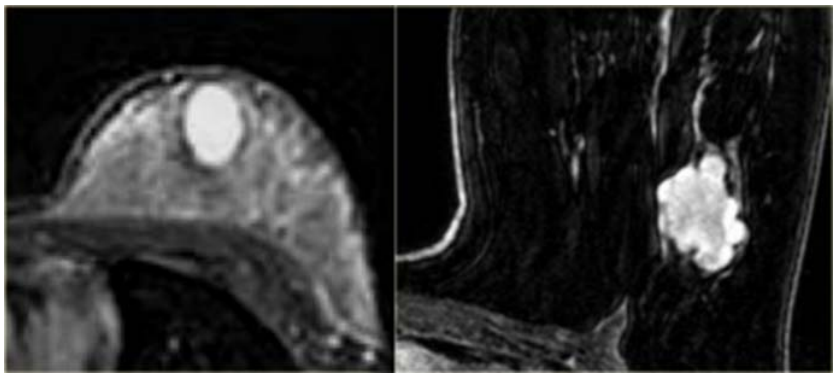
The MRI BI-RADS system describes enhancing lesions :

A focus :enhancing area < 5 mm which is difficult to be further described,these are usually not harmful unless there is a rapid increase in size.the risk of malignancy increases with the size of the lesion. Thus, any foci needs to be monitored carefully to assess the growth of the lesion and changes in the nature of enhancement morphology.

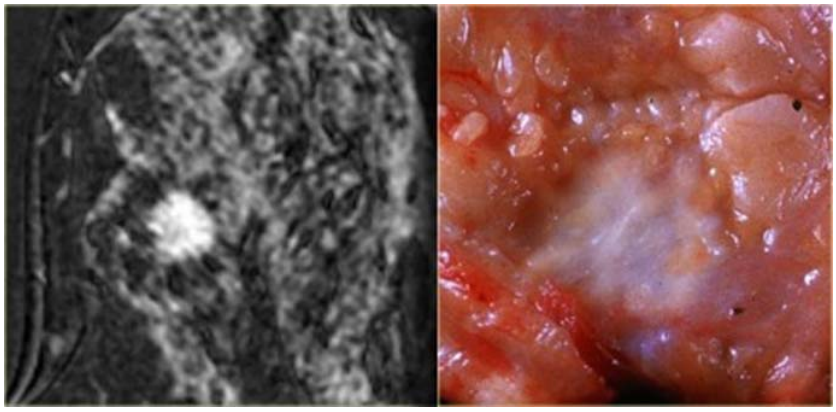


little bright objects detected as foci in MRI

- A mass: space-occupying tumor which has three dimensions and correlates with both T1W and T2W scans. The D/D of a mass maybe invasive breast cancer / benign solid tumor, and detailed analysis of the shape and margin of the mass.



MRI film showing a fibroadenoma



MRI showing speculated margins suggestive of invasive carcinoma

- A non-mass-like enhancement: Enhancing fibroglandular tissue without a detectable three-dimensional mass. The D/D of this could be intraductal invasive cancer, mastopathy, hormonal stimulation or inflammatory changes. The distribution of the enhancement field (whether located along the ductal lining or not) & the symmetry of the enhancement are valuable .

For eg: bilateral asymmetry in non-mass-like enhancement is more often considered to be due to benign lesions

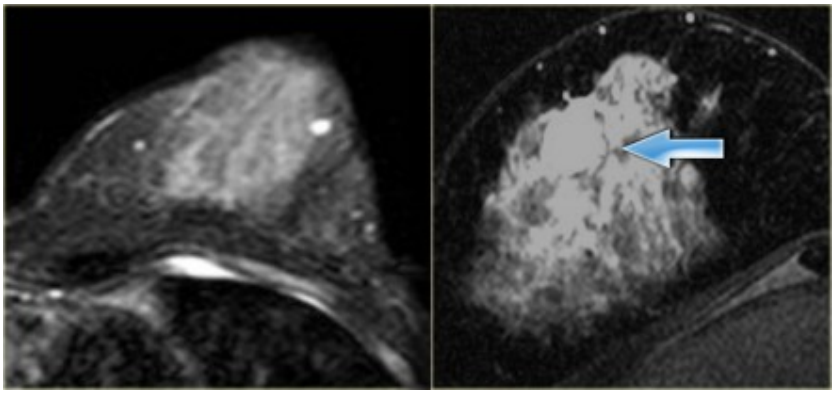
Distribution pattern of a non mass enhancement is as follows:

- Focal: less than 25% of a quadrant
- Ductal : carries a 60% risk of cancer
- Linear :not oriented with the duct,carries 31% risk of cancer
- Segmental:occurs along multiple ducts and carries 78%risk of malignancy
- Regional: non ductal /non segmental ,carries 21% cancer risk
- Diffuse

T1-T2 CHARECTERISTICS:

A pre-contrast T1image without any fat suppression will show fat on a lesion. A signal on a T1W can be observed in intramammary lymphadenopathy/traumatic fat necrosis. Hamartomas also show high signals on T1 images .Fat containing lesion are usually not malignant but suspicion must arise if the tumor is rapidly growing, and biopsy must be taken.

In T2 weighted images, look for the presence of fluid. Cysts, lymph nodes & fat necrosis show a high signal on T2 images.Colloid carcinoma is the only malignancy that produces a high signal intensity on T2 images.There is a general rule: all lesions with high signal on T2 fat-suppressed images are benign & non malignant.



T2W IMAGE SHOWING FIBROADENOMA ON LEFT & COLLOID CARCINOMA ON THE RIGHT

Moderate signal intensity in T2 weighted images are: usually malignant

- invasive lobular carcinoma
- DCIS
- Fibrocystic breast disease

Low signal intensities are seen in:

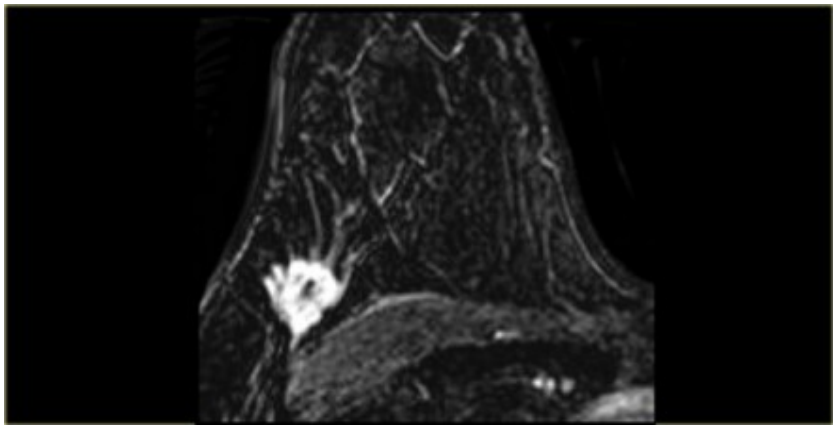
- Invasive ductal carcinoma
- Sclerotic fibroadenoma
- scar

Enhancement pattern of a mass:

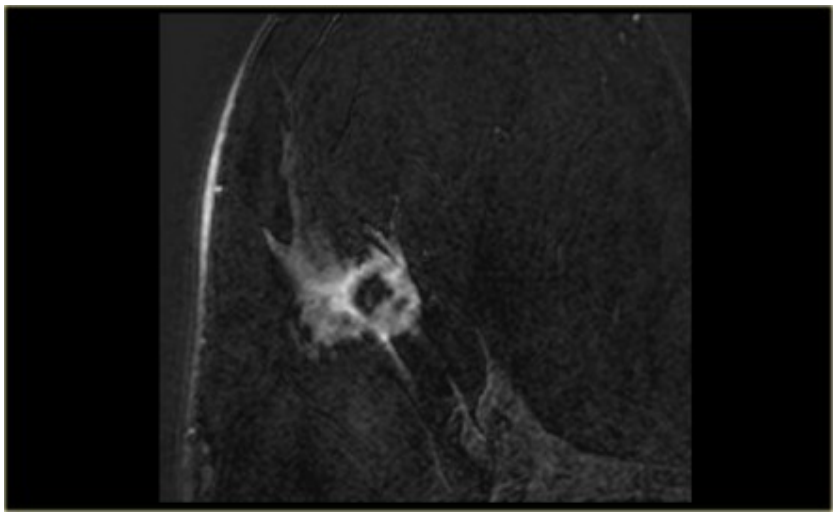
There are six patterns of mass enhancement:

1. *Homogeneous* :uniform & confluent enhancement thro'out the mass.
2. *Heterogeneous:* Irregular enhancement, that varies inside the mass.
3. *Rim enhancement:* involving the periphery of the mass. This is a feature of ductal cancer, traumatic fat necrosis, & benign cysts. Rim enhancement in non cyst like lesions run a 40% risk of cancer.

4. *Dark internal septations* :i.e: an enhancing mass with non-enhancing septations. Eg: fibroadenomas,irregular margins.
5. *Enhancing internal septations:suggestive of* malignancy.
6. *Central enhancement:An enhancing mass along the center of the mass*. Commonly associated with high-grade ductal cancer.



Invasive lobular carcinoma with heterogenous enhancement



Invasive ductal carcinoma with rim enhancement

MRI –BIRADS CLASSIFICATION CATEGORY:

Category 0 Incomplete: requires further imaging evaluation

Category 1 -ve

Category 2 Benign

Category 3 Probably benign

Category 4 Suspicion of malignancy

Category 5 Highly suggestive of malignancy

Category 6 Proven cancer

BREAST MRI –DIAGNOSTIC INTERPRETATION:

Both morphological and kinetic data are assessed in a breast MRI. The kinetic data usually contains 2 fragments: initial enhancement and delayed enhancement. In the lesion morphology: size, shape and margins (boundaries) become important criteria for diagnosis.

- Normal fibroglandular tissue has variable enhancement;with no early phase enhancement and it persists in later phases .

- Invasive cancers : Focal masses with irregular shape and irregular or spiculated margin, and they show washout with heterogeneous internal architecture or rim enhancement. A spiculated mass is alump with spikes-needle-like protrusions on the surface. Invasive cancers are hypointense relative to the fibroglandular tissue in T2weighted images
- Fibroadenoma: benign focal masses with round or oval shape with smooth margins. The enhancement persists but they can also display a washout or plateau, and can have a homogeneous internal architecture with by dark septations they can be hypo intense or hetero intense in T2 weighted image
- Ductal Carcinoma In Situ (DCIS): potential precursor to invasive cancer. It is usually difficult to diagnose due to unreliable enhancement kinetics. DCIS shows asymmetric no mass-like enhancement with hetero genity and periductal enhancement. Benign mastopathies are the most important differential diagnosis with regard to DCIS. As with DCIS, mastopathic lesions present themselves as enhancing foci or area of non-mass-like

enhancement but when compared to DCIS, they are bilaterally symmetric and do not follow the ductal system.

MRI –CLINICAL APPLICATIONS:

MRI of the breast is a modality applicable in several areas of the clinical management of breast disease due to its versatility. Breast MRI's role in screening for breast cancer can be segmented into two primary causes:

1. first line modality for screening women with high risk
2. second line modality for detailed studying of inconclusive findings.
3. After making a diagnosis of invasive cancer, breast MRI can be used in staging the disease& the axillary lymph nodes.
4. It can be used in monitoring a patient's response during or after neoadjuvant chemotherapy.
5. After mastectomy, the patient will often opt for breast implants, and MRI can detect tumor recurrences in these special cases.

Clinical Reports and data show high sensitivity of breast MRI, but its specificity has been variable in diagnosing invasive breast cancer. This variable specificity led to certain inconclusive/unnecessary biopsies,amplified by its cost efficacy and inexperience of the radiologists.

However, as radiologists experience with breast MRI began to increase and by the incorporation of lesion morphology in the diagnostic pathway, breast MRI is now accepted in clinical practice. It is the first-line screening modality for patients with a high risk of cancer in lifetime. Recent studies give a much higher specificity for breast MRI (77-100%) as compared to x-ray mammogram about25-40% for the same high risk group

RECENT ADVANCESINBREAST MRI:

CELLULAR MRI:

It is an imaging technique which incorporates high resolution MRI & cells labeled

With contrast agents to visualize the location of these tumors and behavior of these cells in vivo. The following sections give a brief description of basic MRI principles, pulse sequences, contrast agents and the principles and applications of cellular MRI.

Nuclear Magnetic Resonance (NMR):

Magnetic resonance imaging can be accomplished due to the intrinsic property of subatomic particles called spin /the intrinsic angular momentum of the particle. All protons, neutrons & electrons have a non-zero value of spin. Both the proton & neutron have spin equal to a half. In nuclei with multiple protons & neutrons, the spin of the entire nucleus will be a sum of the spins from all unpaired protons & neutrons. Nuclei with a non-zero spin will have a magnetic dipole & have a magnetic moment. When a proton, having a spin of ½, is exposed to a magnetic field, it will experience a force that causes it to align with the field. But , the proton will not align completely & will precess about an axis that is parallel to the applied field. The frequency of the proton's precession / Larmor frequency, ωo, in an external magnetic field, B0, is givenby the following equation.Where γ is the gyromagnetic ratio, which is 42.57 MHz/T for a proton. When a volume containing many protons are brought under an external magnetic field, as in the case of MRI, a net magnetization is produced within the volume that aligns with the magnetic field. In the volume, not all the protons will precess in a direction that will constructively add to the net magnetization, but will

precess in a way that will reduce the size of the magnetization available to imaging. This is dependent on both the magnetic field strength & the temperature of the volume studied. The magnitude of the net magnetization. When an MRI image is acquired, an oscillating magnetic field, B1, is applied to the volume in addition to B0, exciting the protons. This causes magnetization to tip from the z-axis, which is parallel to B0, into the transverse plane perpendicular to B0.The magnetization will then gradually return to its original orientation parallel to the z-axis once B1 has been switched off. The signal measured by the imaging system during acquisition is the relaxation of the magnetization back to the equilibrium state. During the acquisition process, a series of magnetic field gradients in different spatial directions are applied to encode different frequencies and phases to different areas of the volume, allowing for the location of specific signals to be determined. The signal is detected due to the precession of the magnetization in the transverse plane. This induces a varying voltage & current in a coil that is placed nearby for detection. The magnetization acts as a function of time in the z-axis & transverse plane .Where T1 and T2 are relaxation time constants that describe how the magnetization within a volume will return to equilibrium. These

constants are known as spin-lattice & spin-spin relaxation, respectively,& vary between tissues.The process of relaxation involves two different mechanisms: T1 relaxation and T2 relaxation. These mechanisms are extremely important in determining image contrast & affect the choice of pulse sequence used for imaging. The relaxation constants vary between tissues & will also change in the presence of disease.

AIM OF THE STUDY:

- To evaluate patients presenting with a breast lump and to evaluate them with clinical examination ,cytology and with MRI and interpret its findings- with regards to involvement of the opposite breast and axilla and level of infiltration and the sensitivity of the modality itself.
- To establish that MRI breast can be made as a routine investigating modality in the management of breast cancer by comparing it with mammogram
- To use MRI in detecting local site recurrences in patients with post MRM status presenting with pain /ulcers/nodules.

MATERIALS AND METHODS:

ELIGIBILITY:

INCLUSION CRITERIA:

Women presenting with breast lump with a cytological evidence of breast cancer, both premenopausal and postmenopausal and any stage at presentation.

Women who present post operatively(post MRM)with features of recurrence

STUDY TYPE: Observational

SAMPLE SIZE: 50

METHODS:

Patients who present with complaints of breast lump to the OPD,were clinically examined and subjected to cytology & proved to be carcinoma and further evaluate them with mammogram and MR imaging of both breasts and the results were interpreted with the following criteria:

- Size of the tumor
- Location of the tumor

- Infiltration to underlying structures
- Multicentric lesions
- Involvement of opposite breast and axilla
- Perform MRI for patients post MRM status presenting with operative scar pain/ ulcers/nodules

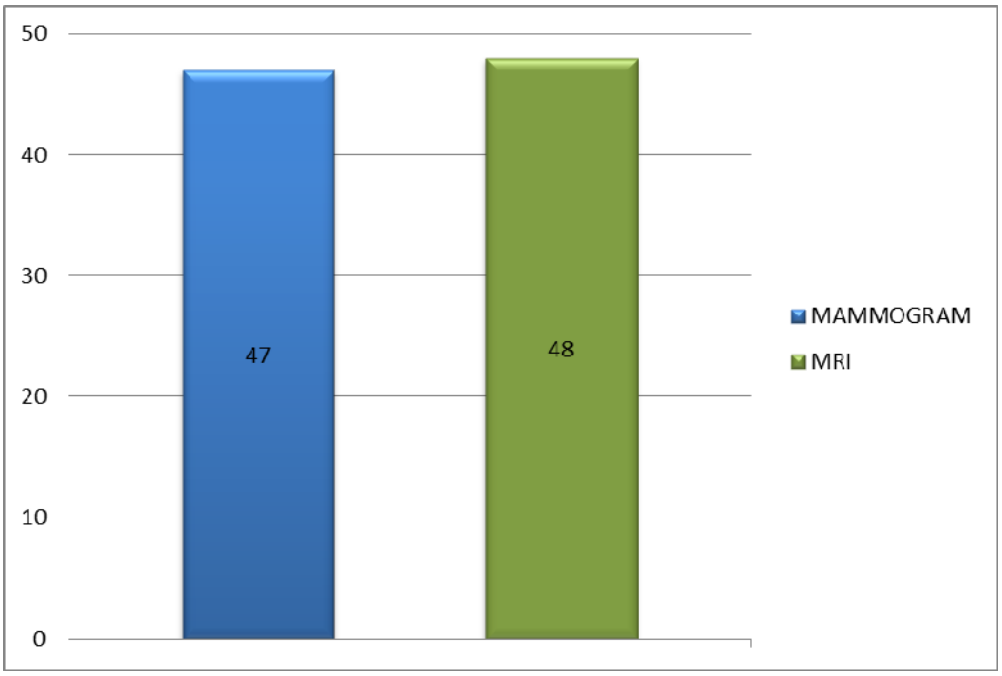
  These results were compared with those of mammogram performed in the same group of patients.

OBSERVATION AND RESULTS:

OBSERVATION AND RESULTS

A Total Of 50 Cases Of Proven Ca Breast Were Studied by both Mammographic And Mri Evaluation . Of The 50 Cases 47 cases were predicted by mammogram and 48 cases were predicted byMRI to be a case of breast carcinoma.

MAMMOGRAM VS MRI BREAST

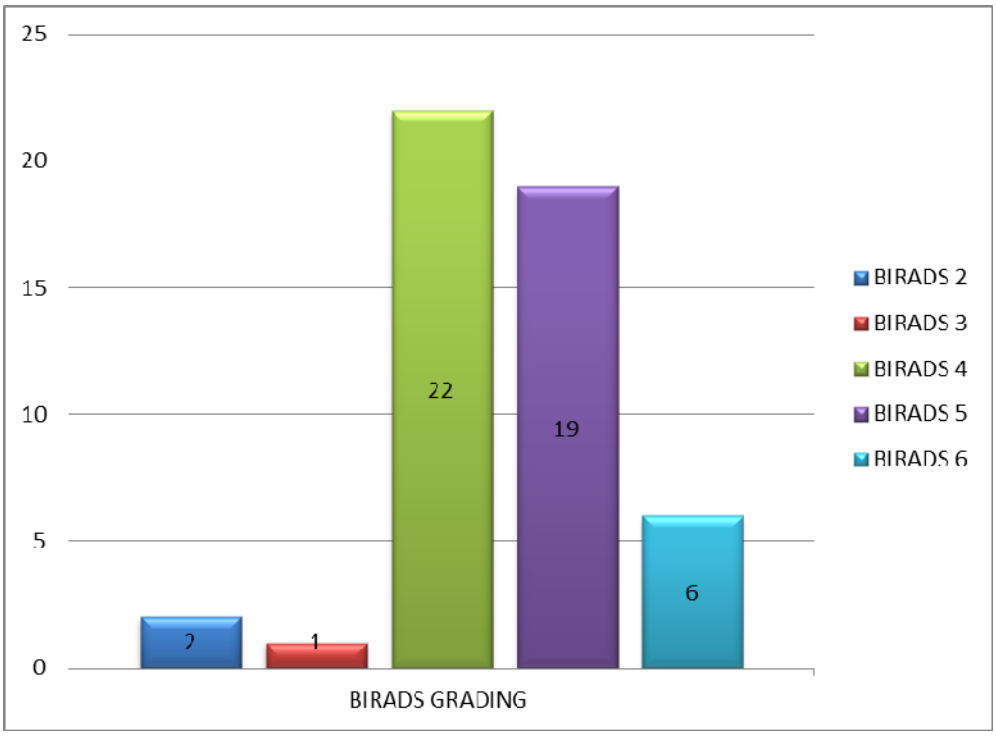


The results were not statistically significant as the p-value calculated by chi square test was0.94143 (when $p<0.01$ is considered significant). It is observed that MRI is as good as mammogram in the evaluation of a case of carcinoma breast .

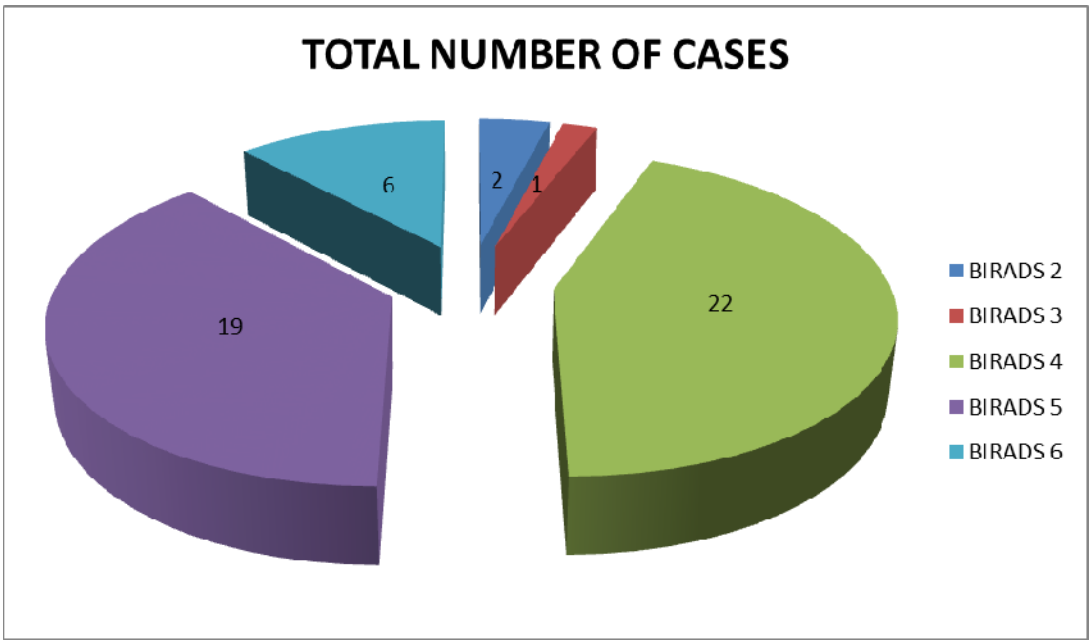
BIRADS grading

BI-RADS is an acronym for Breast Imaging-Reporting and Data System, a quality assurance tool originally designed for use with mammography. . This allows for concise and unambiguous understanding of patient records among doctors .

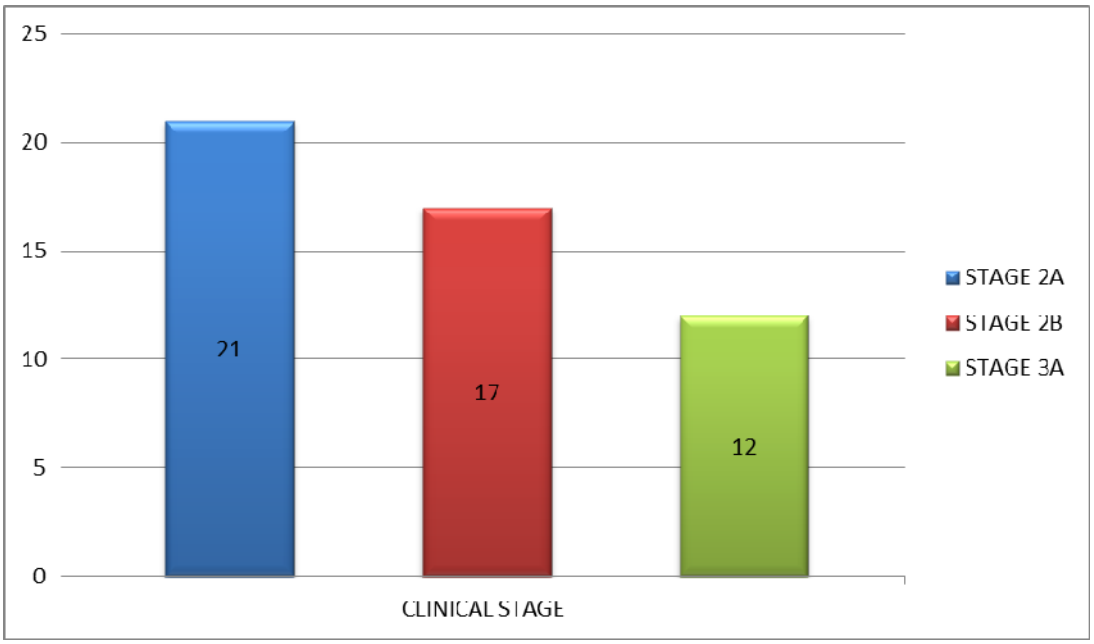
Of the 50 cases subjected to mammographic evaluation, 22 were under BIRADS 4 , 19 under BIRADS 5 and 6 under BIRADS 6



BIRADS:


TOTAL NUMBER OF CASES
6
2
1
22
19
BIRADS 2
BIRADS 3
BIRADS 4
BIRADS 5
BIRADS 6

STAGING:

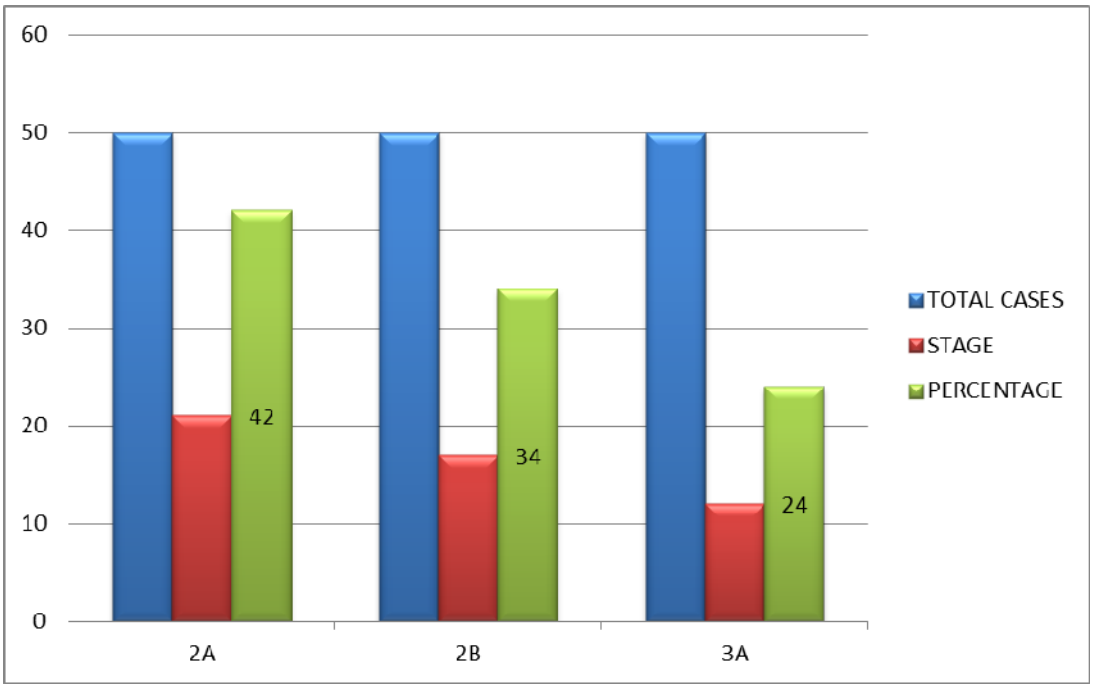


OF THE 50 PATIENTS 21 WERE IN STAGE 2A WITH AN INCIDENCE OF 42 % , 17 WERE IN STAGE 2B WITH AN INCIDENCE OF 34% AND 12 WERE IN STAGE 3A WITH AN INCIDENCE OF 24 %.

Breast cancer staging using the TNM system is based on the size of the tumor (T), whether or not the tumor has spread to the lymph nodes (N) in the armpits, and whether the tumor has metastasized (M) (i.e. spread to a

more distant part of the body). Larger size, nodal spread, and metastasis have a larger stage number and a worse prognosis.

STAGING:



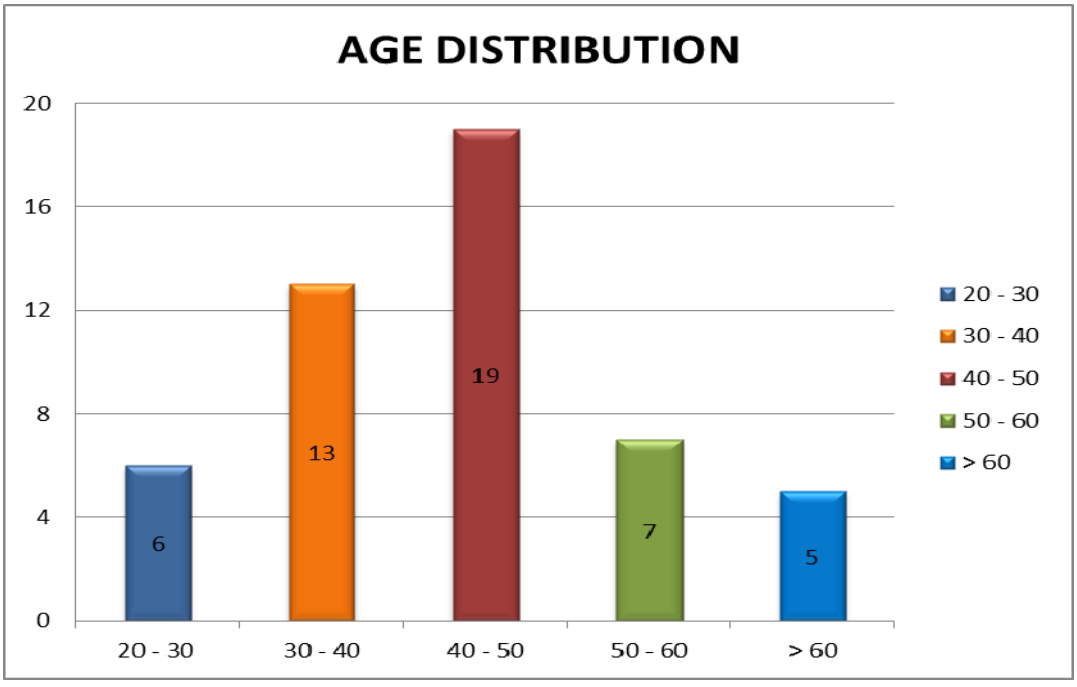
STAGE: 2A: 42%

STAGE :2B :34%

STAGE 3A:24%

AGE DISTRIBUTION

The older you are, the higher your absolute risk of breast cancer. Many women are more interested in the risk of being diagnosed with breast cancer at specific ages or over specific time periods than in the risk of being diagnosed at some point during their lifetime.



WOMEN FROM AGE GROUP 20-30 YEARS OF AGE : 6

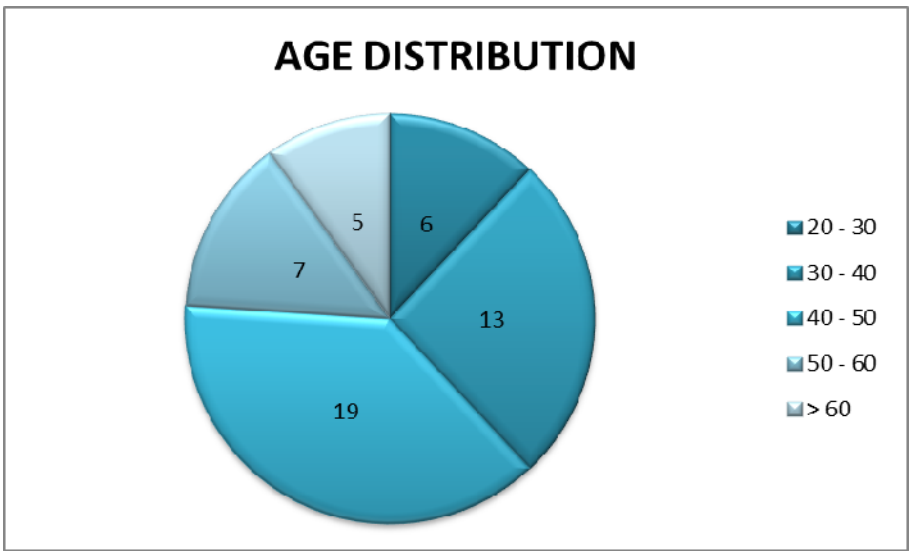
WOMEN FORM AGE GROUP 30-40 YEARS OF AGE: 13

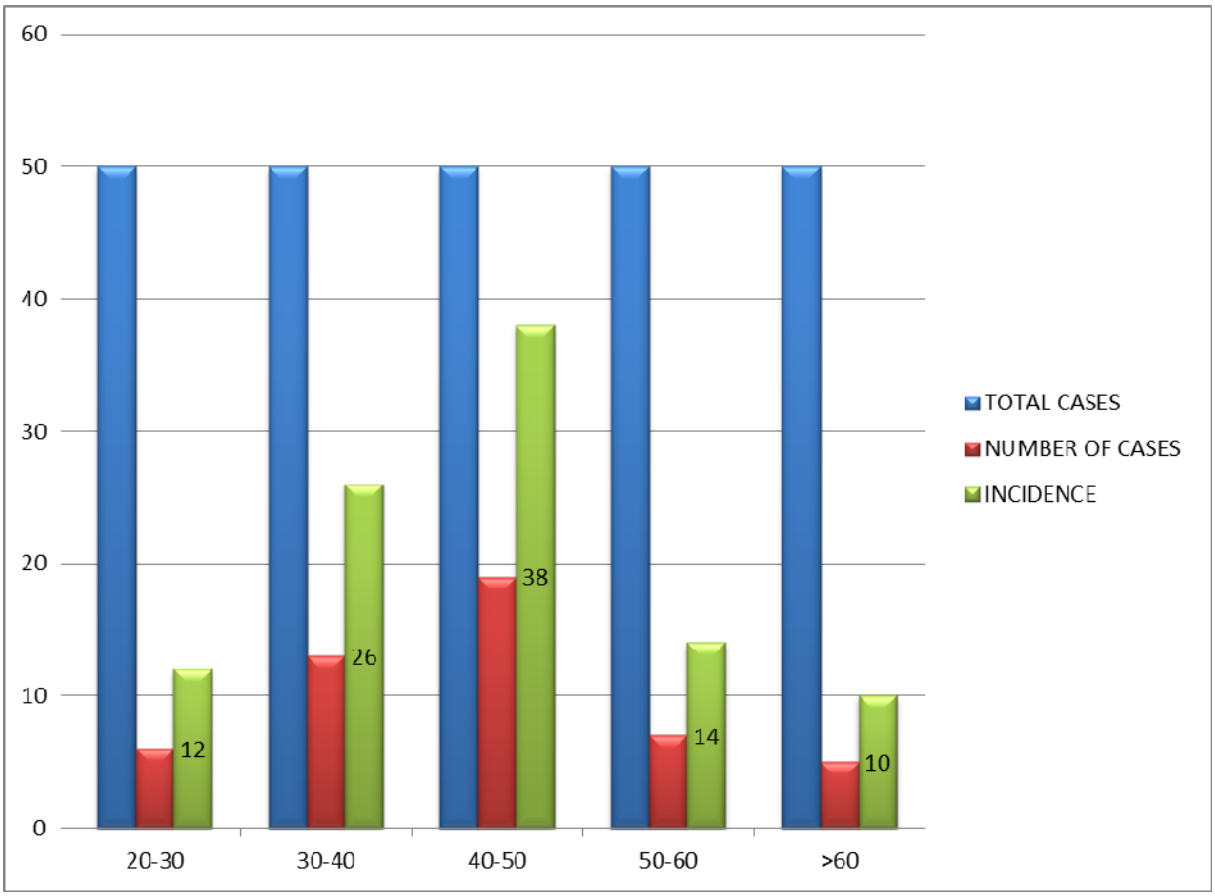
WOMEN FROM AGE GROUP 40-50 YEARS OF AGE: 19

WOMEN FROM AGE GROUP 50-60 YEARS OF AGE:7

WOMEN ABOVE THE AGE 60 YEARS OF AGE: 5

The strongest risk factor for breast cancer is age. A woman's risk of developing this disease increases as she gets older. The risk of breast cancer, however, is not the same for all women in a given age group.





Of the 50 cases , 12 % is in the age group of 20-30

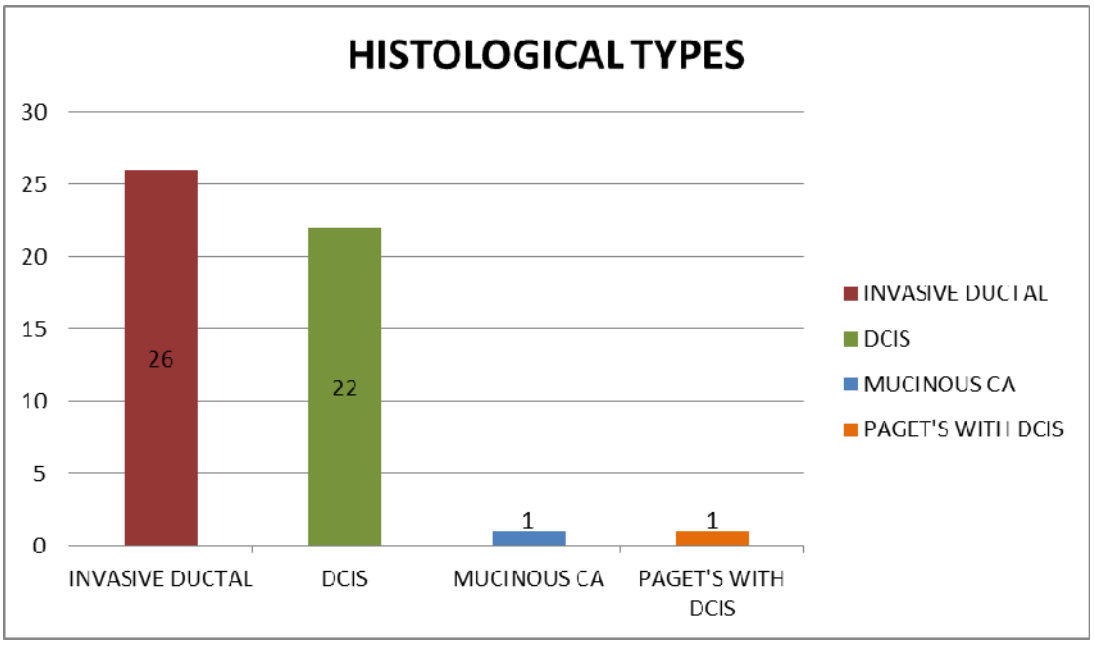
26 % is in the age group of 30-40

38 % is in the age group of 40-50

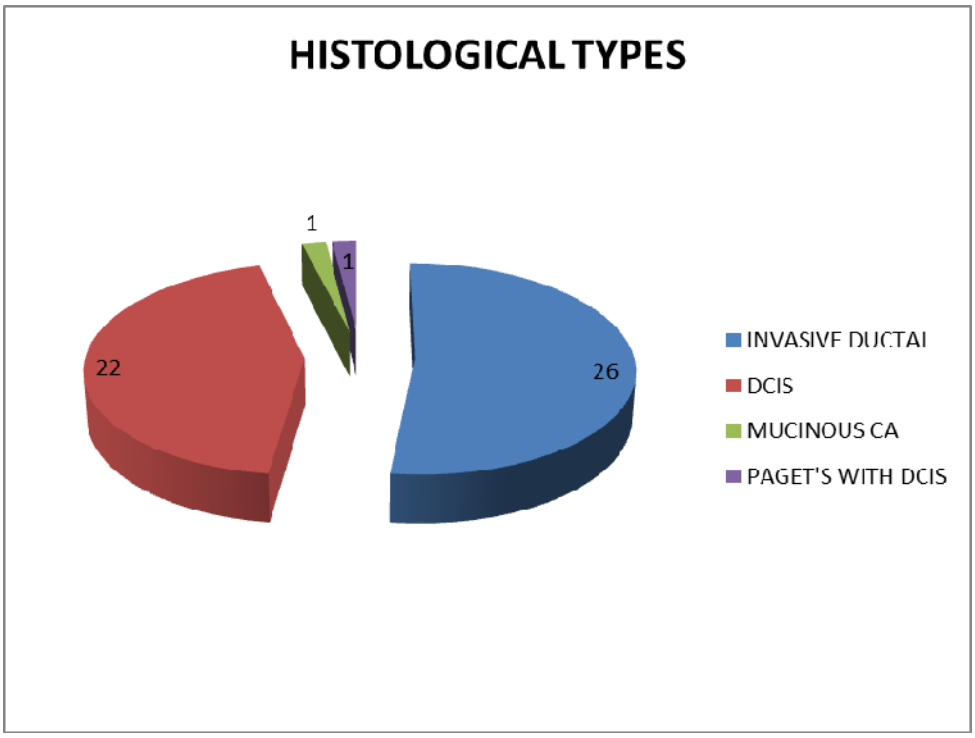
14 % is in the age group of 50-60

10 % is in the age group of >69

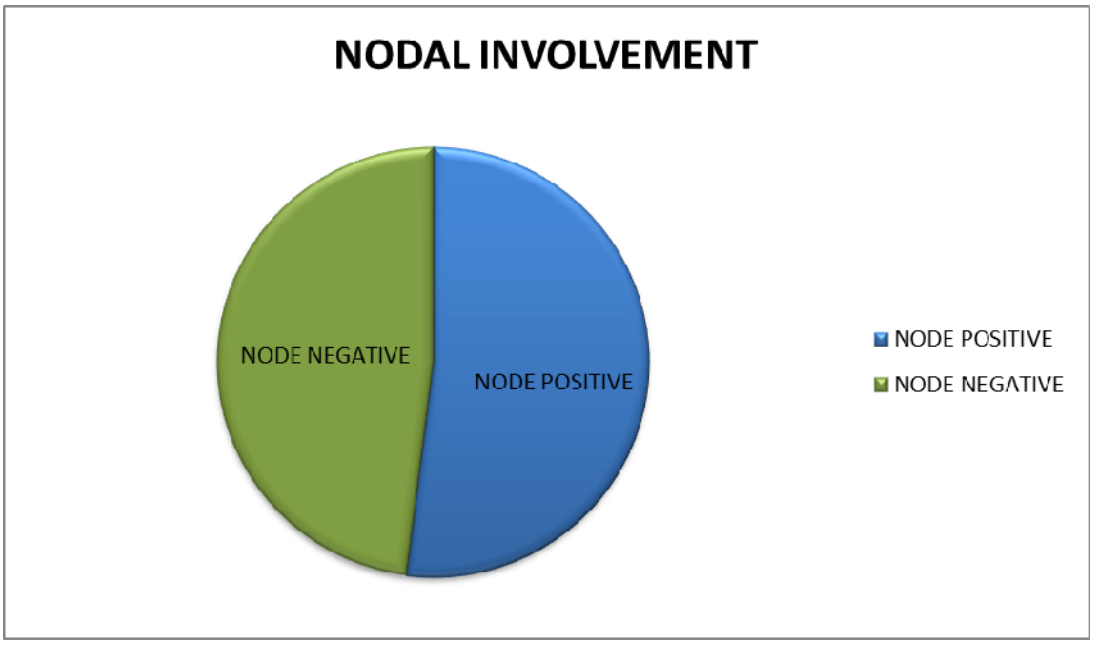
HISTOLOGICAL TYPES



OUT OF THE 50 CASES , INVASIVE DUCTAL CA WAS SEEN IN 26 PATIENTS , DCIS IN 22 PATIENTS , MUCINOUS CARCINOMA WAS SEEN IN 1 PATIENTS AND PAGET'S DISEASE WITH DCIS IN 1 PATIENT


HISTOLOGICAL TYPES
1
1
22
26
INVASIVE DUCTAL
DCIS
MUCINOUS CA
PAGET'S WITH DCIS

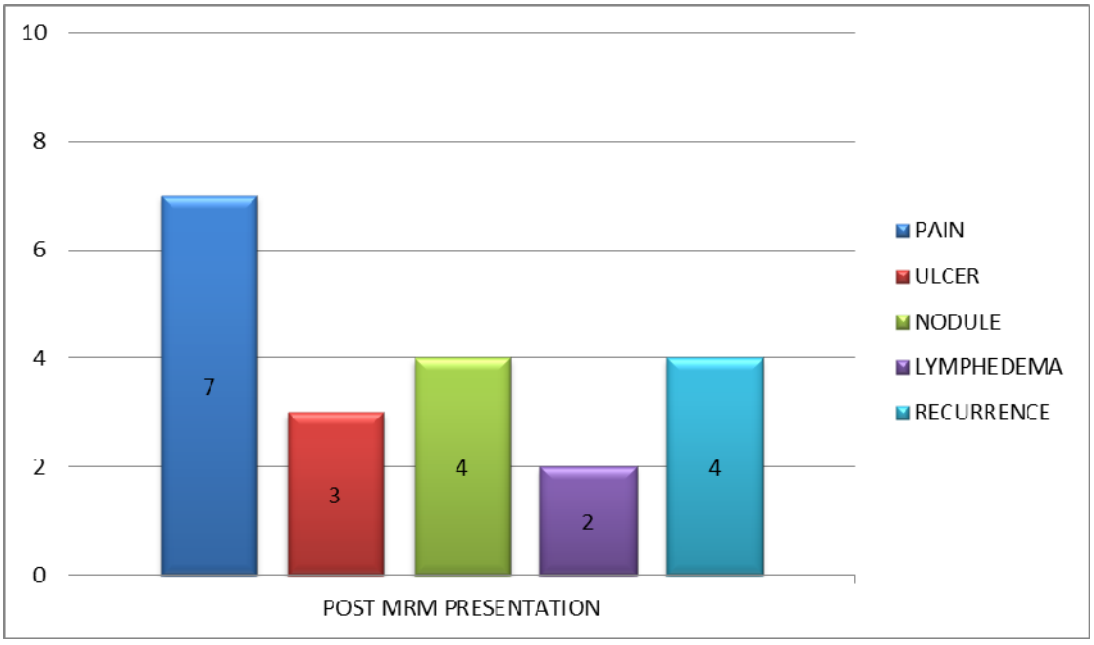
NODAL INVOLVEMENT:



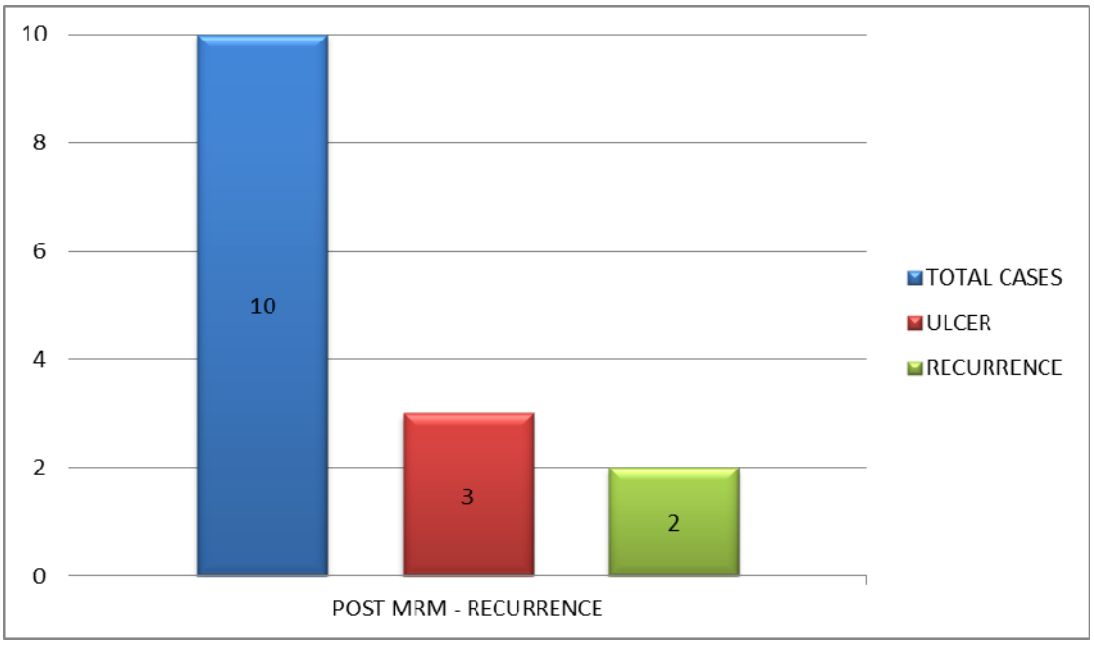
OF THE 50 CASES STUDIED , 26 CASES WERE NODE POSITIVE WHILE 24 WERE MODE NEGATIVE.

POST MRM PRESENTATIONS:

10 CASES OF POST MRM STATUS WERE STUDIED. OF WHICH 7 PATIENT PRESENTED WITH PAIN , 3 CASES PRESENTED WITH ULCER , 4 CASES PRESENTED WITH A NODULE , 2 CASES PRESENTED WITH LYMPHEDEMA AND OUT OF THE 10 CASES RECURRENCE WAS FOUND IN 4 CASES BOTH BY TISSUE DIAGNOSIS AND BY MRI



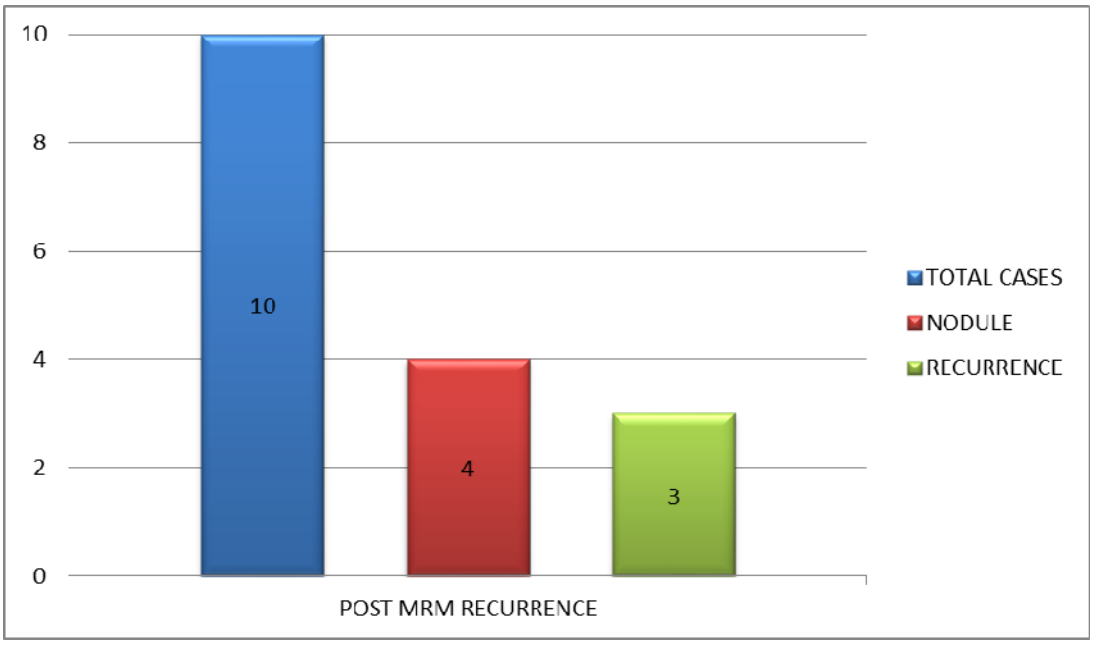
ULCER



Patients presenting with ulcer:3

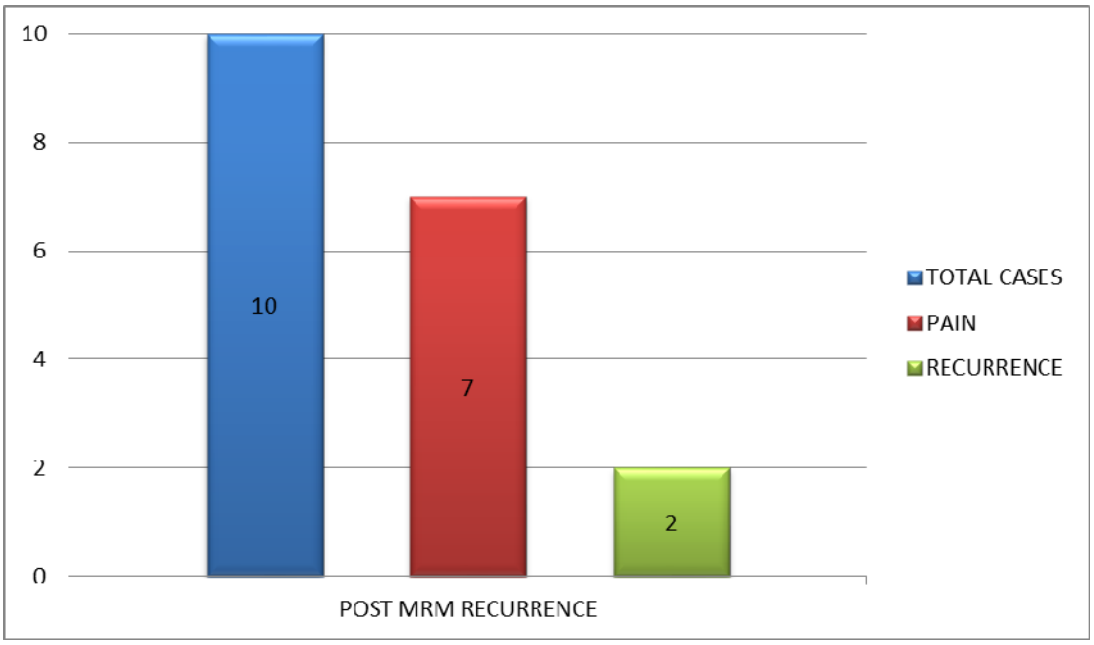
Pateints with recurrence among the ulcers: 2

NODULES

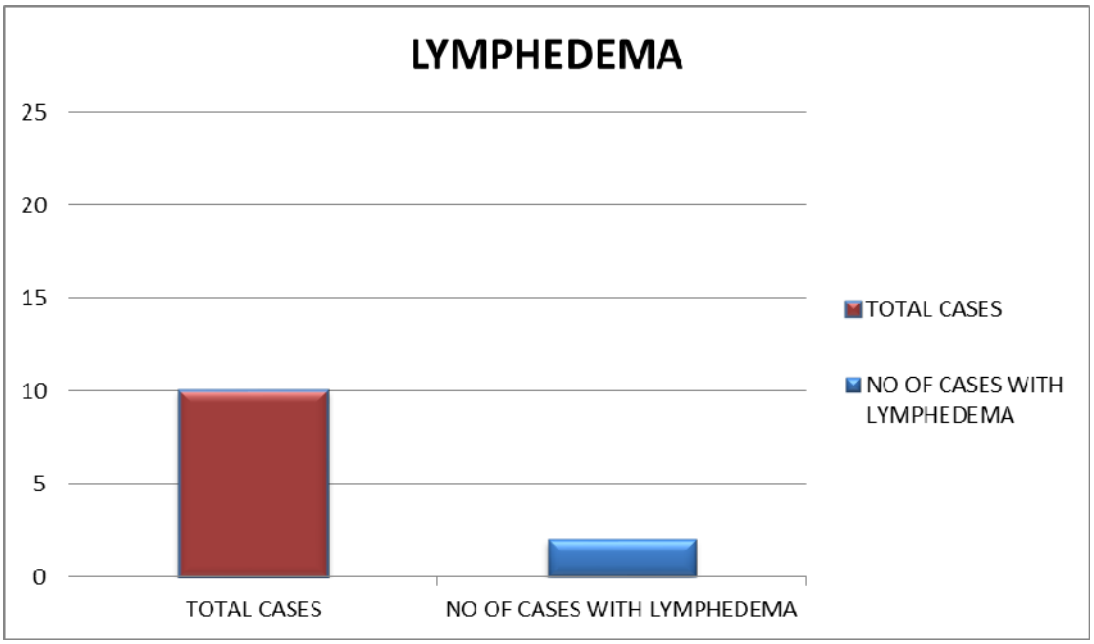


Patient spresenting with nodules were 4 out of which 3 were recurrent.

PAIN



Out of 7 pateints presenting with pain 2 cases were proved recuurent.



2 CASES OF THE 10 CASES OF STATUS POST MRM , PRESENTED WITH LYMPHEDEMA OF THE INVOLVED ARM , WITH AN INCIDENCE OF 20 %.

DISCUSSION:

Conventional mammogram is incorporated routinely in both screening and diagnostic modalities of investigations of the breast. Mammogram is considered as a very reliable method for screening in the case of breast carcinoma.

In this study 50 patients who presented to the surgical OPD were evaluated with their consent. History taking, physical examination followed by imaging were done systematically. All the patients underwent both mammogram and MRI ,and their results analysed.

Out of the total 50 Cases Of Proven Carcinoma breast Were Studied by both Mammographic And MRI Evaluation . Of The 50 Cases 47 cases were predicted by mammogram and 48 cases were predicted byMRI to be a case of breast carcinoma.

Out of the50 patients 21 had a stage 2A disease(42%) , 17 had STAGE 2B disease(34%)and 12 had STAGE 3A(24%).

In BIRADS grading of the breast using a mammogram 19/50 patients had a BIRADS 5 lesion ,22/50 had BIRADS4,6/50 had BIRADS 6,2 /50 had BIRADS 2 & only 1 patient had BIRADS 3.

Age is the highest known risk factor for carcinoma breast and in this study out of 50 patients who presented 6 belonged to 20-30 yrs .i.e: 12% incidence,13 patients belonged to 30-40 yrs(26%),19 belonged to 40-50 yrs(38%) and 7 belonged to above 50 age group(14%)

Out of the 50 patients 26 had invasive ductal carcinoma,22 patients had ductal carcinoma in situ in atypical hyperplasia background,1 patient had mucinous carcinoma and 1 patient had paget's disease of the nipple .

Among the 50 patients 26 cases had lymph node positive disease and 24 were lymph node negative.

48 patients in this study underwent only modified radical mastectomy either before or after chemotherapy, and were on regular follow up.2 of them underwent palliative chemoradiation.

Out of these patients 10 had complaints of pain,ulcer,nodules and lymphedema.7 patients had pain ,4 presented with a nodule,3 cases with

an ulcer and 2 cases with lymphedema and out of them 4 had a recurrence proven with the aids of MRI and biopsy.

On more detailed analysis,2 out of 7 patients with pain had recurrence.3 out of 4 patients with nodule were recurrent,2 out of 3 patients with ulcer had recurrence. 2 out of 10 cases with lymphedema however did not turn out to be recurrence by further investigations.

With regard to MRI as seen in the master chart showed additional features of involvement of the pectoral muscles in 6 cases ,and also detected opposite breast involvement in 2 cases .these cases underwent only palliative chemotherapy.

LIMITATIONS OF THE STUDY:

The major limitation of the study was cost factor which was overcome by the insurance scheme covered for these patients, and also recent advances are not available in the institution like the guided biopsy techniques that could have been used and analyzed. 4 out of the 50 patients developed claustrophobia that required sedation.

CONCLUSION:

To conclude, in this study both MRI and mammogram detected almost equal number of cases ,and the results obtained were not statistically significant.in this group both the modalities were of equal efficacy in diagnosing cancer of the breast.in addition MRI could also give valuable information regarding the level of infiltration and involvement of opposite breast and axilla ,that helped in appropriate staging and induction of neo-adjuvant /palliative chemotherapy.

SUMMARY:

In this sample size of patients ,the p value did not turn out significant(0.94143) and hence the comparison was not statistically significant .However, recent studies conducted in a larger population have shown that MRI has a better tumour predictability by terms of sensitivity when compared to a mammogram.hence MRI scanning of the breast can be included in both screening and diagnosis for breast cancer in institutions where available , as it has various advantages over a mammogram like less radiation exposure ,use in younger age group, ability to add on level of infiltration and involvement of opposite breast and axilla.this one modality can guide the surgeon in deciding the treatment option in patients presenting afresh and post surgical patients

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¾í¸Ùì Ì ÅÂ¢üÚÅÄ¢, þÃò¾ô§À¡ì Ì ÁüÚõ Ì¼ø ÀÆì¸ Á¡üÈõ §À¡ýÈ¨Å þÕôÀ¾¡ø «¾üÌ¡¢Â ¸¡Ã½í¸¨Çì ¸ñ¼È¢Â ¬ºÉÅ¡Â¢Ûû ÌÆ¡ö ¦ºÖòÐõ À¡¢§º¡¾¨É (¦¸¡Ä§É¡Š§¸¡À) ¦ºöÂôÀÎõ. þ¾ý ãÄõ §¿¡¨Âì ¸ñ¼È¢óÐ «¾üÌ¡¢Â º¢¸¢î¨º «Ç¢ì¸ þó¾À¡¢§º¡¾¨É ÀÂýÀÎõ±ýÀ¨¾ ¦¾¡Å¢òÐ ¦¸¡û¸¢§Èý.

¾¡í¸û þó¾ ¬öÅüÌ ºõÁ¾õ ¦¾¡Å¢ìÌõ Àðºò¾¢ø þó¾ ÀÊÅò¨¾ÓØ¨ÁÂ¡¸ ÀÊòÐ À¡÷òÐ ÓØÁÉÐ¼ý ¨¸¦Â¡ôÀÁ¢ÎÁ¡Ú §¸ðÎì ¦¸¡û¸¢§Èý. §ÁÖõ þó¾ ¬öÅ¢É¡ø ¾í¸û ¯¼Ö째¡, ÁÉÐì§¸¡, ±ó¾Å¾¯¨ÇîºøÂüÀ¼¡Ð±ýÚõ¯Ú¾¢ÂÇì¸¢§Èý.

þó¾ ¬öÅ¢ý ÓÊ×¸û ÁÕòÐÅì ¸¡Ã½í¸Ùì¸¡¸×õ ÁÕòÐÅì ¸øÅ¢ì¸¡¸×õ ÀÂýÀÎò¾ôÀÎõ. þó¾ ¬ö× ÅüÈ¢Â ºó§¾¸í¸Ùì Ì ¡¢Â Ó¨ÈÂ¢ø Å¢Çì¸õ «Ç¢ì¸ôÀð Î, ¾í¸¨ÇÅüÈ¢Â ¾¸Åø¸û þÃ¸º¢ÂÁ¡¸ À¡Ð¸¡ì¸ÅÀÎõ.

þó¾ ¬öÅ¢ÄÕóÐ ±ô¦À¡ØÐ §Å ñ ÎÁ¡É¡Öõ ¾¡í¸û ±ùÅ¾ Óý É È¢Å¢ôÀ¢ýÈ¢Ôõ, ±ùÅ¾ ºð¼ º¢ì¸Öõ þýÈ¢Ôõ Å¢Ä¸ì ¦¸¡ûÇÄ¡õ.

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¦ÀÂ÷:

WORKSHEET:

NAME:

AGE: SEX: IP NO:

DIAGNOSIS:

CLINICAL DETAILS:

FNAC/BIPOSY REPORT:

MAMMOGRAM:

MRI BREAST:

OUTCOME:

POST MRM PATIENTS:

1. Complaints:
2. Presentation:
3. MRI finding:
4. Cytology:

AGE	SEX	I.P NO	PAIN	ULCER	NODULE	LYMPHEDEMA	RECURRENCE	MRI PREDICTABILITY
55	FEMALE	35467	YES	NO	YES	NO	YES	YES
48	FEMALE	32690	YES	NO	NO	NO		
52	FEMALE	41350	YES	YES	YES	NO	YES	YES
65	FEMALE	27889	NO	NO	NO	YES		
39	FEMALE	34589	NO	YES	YES	NO	YES	YES
54	FEMALE	39021	YES	NO	NO	NO		
43	FEMALE	28923	YES	YES	NO	NO	YES	YES
48	FEMALE	31267	NO	NO	NO	NO		
56	FEMALE	30956	YES	NO	YES	NO		
68	FEMALE	41590	YES	NO	NO	YES		

S.NO	NAME	AGE	SEX	IP NO	SIDE	NODAL DISEASE	CLINICAL STAGE	HISTOLOGICAL POSITIVITY	HISTOLOGICAL TYPE	MAMMOGRAM PREDICTABILITY	BIRARDS GRADING	CONTRALATERAL INVOLVEMENT	MRI PREDICTABILITY	CONTRALATERAL INVOLMENT	PECTORAL FASCIAL INVOLMENT	OPERATIVE MANAGEMENT
1	VIJAYA	47	FEMALE	29755	RIGHT	NO	2A	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
2	INDRA	28	FEMALE	33518	LEFT	YES	3A	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
3	VETHAVALLI	20	FEMALE	34605	RIGHT	NO	2A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
4	RADHIKA	30	FEMALE	35542	RIGHT	N0	2B	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
5	DEVI	44	FEMALE	35466	LEFT	YES	3A	YES	DCIS	YES	6	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
6	KOWSALYA	54	FEMALE	36635	RIGHT	YES	2B	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
7	SHANTHI	56	FEMALE	33414	RIGHT	NO	2A	YES	VASIVE DUCTAL	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
8	RAMYA	28	FEMALE	37741	RIGHT	NO	2B	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
9	LAKSHMI	29	FEMALE	41188	LEFT	YES	3A	YES	VASIVE DUCTAL	YES	5	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
10	NAVANEETHAM	40	FEMALE	43037	RIGHT	NO	2A	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
11	BALAMMA	40	FEMALE	43014	RIGHT	NO	2A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
12	JANAGI	54	FEMALE	42978	LEFT	YES	2A	YES	AGET'S WITH DC	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
13	GOWRI	50	FEMALE	42226	LEFT	NO	2B	YES	VASIVE DUCTAL	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
14	BHAVANI	33	FEMALE	47122	RIGHT	YES	2B	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
15	SARASWATHY	30	FEMALE	47563	RIGHT	YES	2B	YES	VASIVE DUCTAL	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
16	KUMARI	43	FEMALE	49314	RIGHT	NO	2A	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
17	PUSHPA	41	FEMALE	42694	RIGHT	NO	2A	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
18	CHINNAPONNU	38	FEMALE	44640	LEFT	YES	3A	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
19	JAMUNA	46	FEMALE	44724	LEFT	YES	2B	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
20	LOGA	65	FEMALE	44533	LEFT	YES	3A	YES	VASIVE DUCTAL	YES	6	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
21	DEVAKI	38	FEMALE	46743	LEFT	NO	2A	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
22	RADHA	45	FEMALE	47001	RIGHT	YES	2A	YES	VASIVE DUCTAL	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
23	KANAGA	45	FEMALE	21483	LEFT	NO	2B	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
24	SAIMUNISHA	48	FEMALE	36991	RIGHT	YES	3A	YES	VASIVE DUCTAL	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE

25	PARVEEN	36	FEMALE	38810	RIGHT	NO	2A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
26	USHARANI	45	FEMALE	41327	LEFT	NO	2A	YES	VASIVE DUCTAL (	NO	2	NO	NO	NO	NO	MRM/ AXILLARY CLEARANCE
27	VELUMANI	49	FEMALE	46018	LEFT	NO	2B	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
28	SARASWATHY	34	FEMALE	21335	RIGHT	YES	2B	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
29	KALA	47	FEMALE	22406	RIGHT	YES	3A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
30	NIRMALA	45	FEMALE	23086	RIGHT	NO	2A	YES	VASIVE DUCTAL (	NO	3	NO	NO	NO	NO	MRM/ AXILLARY CLEARANCE
31	GOWRI	50	FEMALE	34746	LEFT	YES	3A	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
32	NAVANEETHAM	40	FEMALE	42352	RIGHT	NO	2A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
33	VERONIKA	55	FEMALE	44730	LEFT	YES	3A	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
34	HAMSA	34	FEMALE	44571	LEFT	NO	2A	YES	DCIS	NO	2	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
35	JANAKI	44	FEMALE	38491	LEFT	YES	2B	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
36	JANAKI	64	FEMALE	33625	LEFT	NO	2A	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
37	CHRISTINAMARY	62	FEMALE	41709	LEFT	NO	2A	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
38	MOGINI	55	FEMALE	43256	RIGHT	YES	2B	YES	DCIS	YES	6	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
39	RAVANAMMAL	50	FEMALE	25608	RIGHT	YES	3A	YES	CINOUS CARCINC	YES	4	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
40	INDRANI	45	FEMALE	48921	LEFT	NO	2A	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
41	SARITHA	36	FEMALE	34569	LEFT	YES	2A	YES	VASIVE DUCTAL (	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
42	RENUKA	46	FEMALE	32786	RIGHT	NO	2A	YES	VASIVE DUCTAL (	YES	6	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
43	LALITHA	37	FEMALE	45803	RIGHT	NO	2B	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
44	GOVINDAMMAI	39	FEMALE	34590	LEFT	YES	2A	YES	DCIS	YES	6	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
45	CHENGAMMA	42	FEMALE	32489	LEFT	NO	2B	YES	DCIS	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
46	RAJESHWARI	59	FEMALE	38905	RIGHT	YES	2B	YES	VASIVE DUCTAL (	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
47	ANNATHAI	49	FEMALE	45097	LEFT	YES	3A	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
48	SANGEETHA	54	FEMALE	47823	RIGHT	YES	2B	YES	DCIS	YES	4	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE
49	SAKUNTHALA	65	FEMALE	34790	LEFT	YES	3A	YES	VASIVE DUCTAL (	YES	6	NO	YES	NO	YES	MRM/ AXILLARY CLEARANCE
50	HINNAKOLANTH	68	FEMALE	49201	LEFT	YES	2B	YES	VASIVE DUCTAL (	YES	5	NO	YES	NO	NO	MRM/ AXILLARY CLEARANCE

INSTITUTIONAL ETHICAL COMMITTEE, STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : A value based study on magnetic resonance imaging and Comparison with mammogram in the evaluation of carcinoma breast

Principal Investigator : Dr.B. Amirtha

Designation : PG in M.S.(Gen.Sur)

Department : Department of Gen.Sur
Government Stanley Medical College,
Chennai-10

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 13.06.2013 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

MEMBER SECRETARY,
IEC, SMC, CHENNAI

3/12/13

INTRODUCTION:

Dynamic MRI of the breast is vi
supplementary to mammograp
additional diagnostic informatic
include examination of patients
and patients having prosthetic
useful for differentiation betwe
as to exclude a multicentric bre
sensitivity of MR mammograph
diagnosed with breast cancer, a

- Size of the tumor and lev
- The presence of multi ce
  an undetected tumor in t

Match Overview

1	www.cancer.gov Internet source	1%
2	pinkispowerful.com Internet source	1%
3	health.yahoo.com Internet source	1%
4	Submitted to Massach... Student paper	<1%
5	Submitted to Mahidol U... Student paper	<1%
6	www.medbib.com Internet source	<1%
7	surgeryprocedure.info Internet source	<1%
8	womenshealthsection.c... Internet source	<1%
9	"Permission Acknowled... Publication	<1%
10	L. Vaidyanathan. "Beni... Publication	<1%